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Aseptic Meningitis: Isolation of Coxsackie and Unidentified Cytopathogenic Viruses from Cerebrospinal Fluid by Tissue Culture Methods

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WIDESPREAD use of virus diagnostic tests has led to the recognition of many viral causes of the syndrome of benign aseptic meningitis. The viruses most frequently associated with this disease are poliomyelitis, mumps, lymphocytic choriomeningitis, herpes simplex, and equine encephalitis. There has been much discussion as to the role of Coxsackie viruses. The main evidence that has been brought forward by various authors concerning the aetiological role of Coxsackie viruses, especially those classified as belonging to Group B, in benign aseptic meningitis, has been summarized as follows (7, 10).

1. Coxsackie viruses have, not uncommonly, been isolated from the stools of cases of benign aseptic meningitis. Tests on specimens from such patients have failed to reveal poliomyelitis virus, and serological tests have shown an increased titre of Coxsackie antibody in convalescence. Such evidence of infection has been obtained in cases of benign aseptic meningitis occurring in the absence of recognizable poliomyelitis infection in the community.

2. Benign aseptic meningitis occurs not infrequently as a complication of epidemic myalgia (Bornholm disease) now universally recognized as a manifestation of Coxsackie infection.

Aided by a grant from the Canadian Life Insurance Officers Association (Dr. A. J. Rhodes).
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3. Laboratory workers infected while investigating Coxsackie viruses have developed benign aseptic meningitis.

More recently, the role of Coxsackie virus (Group B) in the aetiology of aseptic meningitis has been much more firmly established, for isolations have been made from the cerebrospinal fluid of cases of benign aseptic meningitis (4, 5, 6).

It is the purpose of this paper to report additional isolations of Coxsackie virus (Group B) from the cerebrospinal fluids of cases of benign aseptic meningitis. Our isolations were made in tissue cultures prepared from monkey kidney treated with trypsin, and this emphasizes the extreme value of this new technique in the isolation of viruses (1, 16).

We also report two isolations from cerebrospinal fluid of agents similar to those recovered by ourselves and others from the stools of cases of clinical poliomyelitis; these agents resemble poliomyelitis virus in their cytopathogenic effects in tissue culture, but are antigenically distinct (2, 3, 8, 12, 14, 15). These so-called "orphan" or "unidentified cytopathogenic" strains do not infect any of the commonly used experimental animals, including suckling mice. There appears to be no doubt that these agents are pathogenic for man, for an increase in antibody titre in convalescence has been detected in some of the patients. Furthermore, an agent belonging to this general category has been isolated from the spinal cord by Steigman (13).

Methods

Study in 1952

Cerebrospinal fluids, as well as other specimens, were collected in the summer and fall of 1952 from a closely studied group of 33 patients admitted to The Hospital for Sick Children, Toronto, with a diagnosis of "aseptic meningitis probable non-paralytic poliomyelitis". Cerebrospinal fluids were also available from another 19 patients admitted at the same time with the same diagnosis. The results of detailed laboratory studies on this series have been published previously, and will therefore be reviewed in brief only (2). In 1952 there was a mild outbreak of aseptic meningitis in Toronto; there were very few cases of paralytic disease in this year. Six of the 33 patients who were intensively studied were found to excrete poliomyelitis virus in the stool, whereas 18 excreted Coxsackie virus; in this investigation, suckling mice, monkeys, and monkey testis fragment tissue cultures were all employed. Cerebrospinal fluid from the 33 patients was inoculated in suckling mice, but none became sick; the same results were obtained with the fluids of the 19 additional patients. All specimens collected in 1952 were stored in a carbon dioxide "dry-ice" box until the present investigation in 1954, in which inoculation of trypsinized monkey kidney tissue cultures was employed.

Methods in Present (1954) Study

The technical methods employed have been described in detail elsewhere, so need be mentioned only in brief (11).

Monolayer cultures of kidney epithelium were prepared by treatment of a suspension of rhesus monkey kidney with trypsin (1, 16). Synthetic Medium 199 with the addition of 1% horse serum was employed in the initial stages of

the cultures (9). After five to seven days, the culture fluids were replaced with Synthetic Medium 199 without horse serum; cultures were then ready for infection. Penicillin, 500 units per ml., and streptomycin, 250 micrograms per ml., were added to all media.

Isolation and Investigation of Cytopathogenic Viruses from Cerebrospinal Fluid

Groups of three monolayer cultures were inoculated with 0.3 ml. of cerebrospinal fluid of the 33 closely studied patients, and of the 19 additional patients. The cultures were examined daily for seven days. If no cytopathogenic changes were seen by this time, the cultures were reported as negative. Cytopathogenic changes were found in cultures inoculated with the cerebrospinal fluids of six of the 52 patients. Since inadequate specimens were available from one of the patients, no further reference will be made to this isolation. The tissue culture fluids infected with the cytopathogenic agents from the remaining five patients were titrated by inoculating serial tenfold dilutions in groups of five monolayer cultures. End-points were calculated by the Kärber method after seven days, and were expressed as 50% cytopathogenic doses (CPD_{50}). In order to determine whether the agents were neutralized by poliomyelitis antisera, groups of cultures were inoculated with mixtures of 100 CPD_{50} of each agent and the three type-specific poliomyelitis antisera prepared in monkeys. To determine whether commercial gamma globulin, supplied by the Connaught Medical Research Laboratories, neutralized these agents, 100 CPD_{50} of each agent were mixed with ten-fold dilutions of gamma globulin, and the mixtures were inoculated in groups of five monolayer cultures.

Since none of the five agents isolated was neutralized by type specific poliomyelitis antiserum, animal inoculations were carried out with the object of determining the nature of the agents. Tissue culture fluid infected with each agent was inoculated intracerebrally in ten adult mice, and eight suckling mice of less than 24 hours of age; the scarified cornea of a rabbit was also inoculated. Material representing isolations from three patients (5, 8, 27) was inoculated thalamically in rhesus monkeys. Mice and rabbits were observed for three to four weeks, and those showing signs of illness were killed and examined histologically. Rhesus monkeys were killed after three to four weeks, and similarly examined.

Serological Studies on Patients Concerned

Acute phase sera, taken within three to seven days of the onset of illness, and convalescent phase sera, taken mostly one month later, were available from all five patients from whose cerebrospinal fluid cytopathogenic agents were isolated.

Poliomyelitis antibody titres were determined in monolayer tissue cultures with representative strains of three types of poliomyelitis virus as antigens (Mahoney, MEF1, and Saukett). Tests for homologous antibody were carried out with the Coxsackie or unidentified strains isolated from cerebrospinal fluid. An amount of 100 CPD_{50} of each virus was used in these tests; virus-serum mixtures were inoculated in groups of five roller cultures. Cultures were finally examined after seven days, and the serum end-points were expressed as 50% cytopathogenic inhibiting doses ($CPID_{50}$), in terms of final dilutions of serum.

Results

Virus Studies

All 33 cerebrospinal fluid specimens inoculated intracerebrally in suckling mice in 1952 had proved negative. However, on inoculation in monolayer tissue cultures, following a period of storage for two years, five of the spinal fluids yielded cytopathogenic agents (Table I). All of these agents propagated readily in monolayer tissue cultures, and the CPD_{50} titres ranged from $10^{-5.3}$ to $10^{-6.9}$. The agents were not neutralized by any of the type specific poliomyelitis antisera, but all were neutralized by commercial gamma globulin, as determined by tests in tissue cultures.

All five agents proved to be non-pathogenic for adult mice and rabbits. Three agents (Nos. 8, 14, and 22) were pathogenic for suckling mice, and the result of the histological examinations suggested that these were actually Coxsackie viruses belonging to Group B. The stools of these same three patients had been found, when tested by inoculation of suckling mice in 1952, to contain Group B Coxsackie virus (2). The single virus isolated from cerebrospinal fluid in this category that was inoculated in a rhesus monkey (No. 8) produced no clinical illness and no histological changes.

The remaining two agents (Nos. 5, 27) were not pathogenic for suckling mice or rhesus monkeys, and are, for the moment, classified as "unidentified" or "orphan" viruses. A similar agent was isolated in 1952 from the stool of patient No. 5. It should be noted that the term "virus" is used provisionally, as the viral nature of these agents has not been completely established.

Serological tests (Table II) showed that no rise in neutralizing antibody to the three types of poliomyelitis virus occurred in convalescence. In some patients, especially No. 27, an appreciable initial level of one type of poliomyelitis antibody was present, presumably as the result of a previous infection.

In all of the three patients whose spinal fluid yielded Group B Coxsackie virus (Nos. 8, 14, 22), increases in antibody to the homologous strain occurred in convalescence.

A definite rise in homologous antibody occurred in the sera of both the patients (Nos. 5, 27) from whose cerebrospinal fluid unidentified cytopathogenic agents were isolated.

These new results, together with those previously described, suggest that the five patients now reported were suffering from aseptic meningitis caused by Group B Coxsackie virus or the unidentified cytopathogenic agent; there is no evidence that any of the patients suffered from a concurrent poliomyelitis infection.

Clinical Findings

The clinical findings in the five patients concerned are briefly summarized in Table III. The features were those of aseptic meningitis, without any characteristic manifestation.

Discussion

The isolation of three Coxsackie B viruses and two unidentified agents from the cerebrospinal fluid is of some significance in a consideration of the aetiology of benign aseptic meningitis, and in regard to the technical methods used in

TABLE I

ASEPTIC MENINGITIS, TORONTO, 1952: CYTOPATHOGENIC AGENTS ISOLATED FROM CEREBROSPINAL FLUID

Reference number of patient	Date of onset (1952)	Date of collection of C.S.F. (1952)	Primary isolation		Further studies on viruses isolated from C.S.F.					
			Suckling mice (1952)	Monolayer kidney cultures	Suckling mice	Adult mice	Rhesus monkeys	Rabbits	Virus titre in monolayer kidney cultures	Gamma globulin neutralization titre
Coxsackie virus infections										
No. 8	26/7	29/7	—*	C.P.E.**	Coxsackie (B) present	—	—	—	$10^{-6.7}$	$10^{-2.8}$
No. 14	4/8	4/8	—	C.P.E.	Coxsackie (B) present	—		—	$10^{-6.9}$	$10^{-3.0}$
No. 22	10/8	13/8	—	C.P.E.	Coxsackie (B) present	—		—	$10^{-5.3}$	$10^{-2.0}$
"Unidentified" virus infections										
No. 5	23/7	24/7	—	C.P.E.	—	—	—	—	$10^{-7.5}$	$10^{-1.2}$
No. 27	15/8	18/8	—	C.P.E.	—	—	—	—	$10^{-5.7}$	$10^{-2.2}$

*Animals inoculated remained healthy.
**C.P.E.: cytopathogenic effect on cells noted.

TABLE II

ASEPTIC MENINGITIS, TORONTO, 1952: SEROLOGICAL STUDIES ON PATIENTS

Reference number of patient	Days after onset serum collected		Titre of antibody to homologous virus from C.S.F.		Titre of antibody to poliomyelitis viruses*					
					Type 1		Type 2		Type 3	
	Acute (S_1)	Conv. (S_2)	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
Coxsackie virus infections										
No. 8	3	39	$10^{-1.6}$	$10^{-3.0}$	$<10^{-1.3}$	$<10^{-1.3}$	$10^{-2.0}$	$10^{-2.0}$	$<10^{-1.3}$	$<10^{-1.3}$
No. 14	0	35	$10^{-0.2}$	$10^{-2.2}$	$<10^{-1.3}$	$<10^{-1.3}$	$<10^{-1.3}$	$<10^{-1.3}$	$<10^{-1.3}$	$<10^{-1.3}$
No. 22	4	36	$10^{-1.8}$	$10^{-2.5}$	$<10^{-1.3}$	$<10^{-1.3}$	$<10^{-0.3}$	$<10^{-1.3}$	$10^{-1.6}$	$10^{-1.6}$
"Unidentified" virus infections										
No. 5	1	8	$10^{-1.2}$	$10^{-4.0}$	$<10^{-0.3}$	$<10^{-1.3}$	$10^{-1.8}$	$10^{-1.8}$	$<10^{-0.3}$	$<10^{-1.3}$
No. 27	3	38	$10^{-1.0}$	$10^{-2.5}$	$10^{-2.8}$	$10^{-2.8}$	$10^{-0.8}$	$<10^{-1.2}$	$<10^{-0.3}$	$<10^{-1.3}$

*Titres expressed in terms of 50% neutralizing titres ($CPID_{50}$) (final dilutions of serum).

TABLE III

ASEPTIC MENINGITIS, TORONTO, 1952: CLINICAL AND LABORATORY FINDINGS

Number of patient, age and sex	Minor illness	Interval between illnesses (days)	Major illness							Previous infectious disease
			Date of onset (1952)	Clinical features	Laboratory findings on admission					
					W.B.C. per cmm.	C.S.F.				
						Protein mg.%	Sugar mg.%	Chlorides m. equiv./l	Cells/cmm.	
Coxsackie virus infections										
J.A.D., No. 8 4 years, female	Pains in arms, legs, and abdomen for 1 day	3	26/7	Headache, vomiting, sore neck, pains in ears; neck stiffness, T. 100°F., 5 days in hospital	13,600 P. 70% L. 28% M. 2%			122.9	15 L. 100%	Measles, Jan. 1951; aseptic meningitis, Aug. 1951
L.R., No. 14, 6 years, male	Sore throat and fever for 2 weeks	0	4/8	Vomiting, sore throat, drowsiness; neck stiffness, T. 101°F., 5 days in hospital	6,500 P. 84% L. 16%	38.9	21.2	121	700 P. 67% L. 33%	Mumps, 1950
J. F., No. 22, 3 years, female	None		10/8	Headache, fever, vomiting, sore neck, "cold", cough, lassitude; neck stiffness, T. 102°F., enlarged submaxillary and cervical glands, 5 days in hospital	16,150 P. 81% L. 18% B. 1%	20	54.5	118.5	325 P. 70% L. 30%	Measles, 1950
Unidentified virus infections										
D. S., No. 5, 9 months, male	Irritability, one generalized convulsion for 1 day	6	23/7	Generalized convulsion; neck stiffness, T. 104°F., 9 days in hospital	7,400 P. 38% L. 58% M. 4%	23.8	76.0	119.5	225 L. 100%	None
S. H., No. 27, 12 years, female	None		15/8	Headache, vomiting, sore neck, drowsiness; T. 101°F., 4 days in hospital	Total not done P. 76% L. 24%	28.0	71.0	122	180 P. 20% L. 80%	Measles, 1947

the examination of cerebrospinal fluid for viruses. All the specimens of cerebrospinal fluids had been inoculated previously in suckling mice without producing signs of illness, but viruses were isolated two years later by inoculation of monolayer cultures of monkey kidney epithelial cells.

Paired sera from all of the five patients tested showed increases in neutralizing antibody to the homologous agents isolated from spinal fluid. These results suggest that the agents recovered from spinal fluid were in fact responsible for the meningeal illnesses. Since no rise in neutralizing antibody occurred to any of the three types of poliomyelitis virus, it is unlikely that the patients were concurrently infected with poliomyelitis virus, especially as stools had previously failed to yield poliomyelitis virus when tested in monkeys or tissue cultures.

From the results of this study, it would seem advisable in the laboratory investigation of aseptic meningitis to inoculate cerebrospinal fluids routinely in tissue cultures. This is a simple procedure, since the cerebrospinal fluid requires no preparation or treatment before addition to the cultures. Use of this technique will no doubt yield further information as to the causal agents involved in benign aseptic meningitis.

Summary

1. Viruses were isolated from the cerebrospinal fluid of 6 out of a total of 52 cases of "aseptic meningitis probable non-paralytic poliomyelitis" by inoculation in monolayer monkey kidney tissue cultures.

2. Three of the five agents that could be studied in detail were identified as Group B Coxsackie viruses; the other two remain unidentified at present, but fall into the general category of "orphan" viruses.

3. Serological studies revealed an increase in neutralizing antibody to these five agents during convalescence.

4. There was no evidence from isolation or serologic tests that the patients from whose cerebrospinal fluid viruses were isolated were concurrently infected with poliomyelitis virus.

5. The clinical features of the five patients concerned were those of benign aseptic meningitis and not specific.

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School Health Practices: Ritualistic or Purposeful?

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WHAT is the meaning of what we are doing? is a question that should be posed sometimes, though perhaps not too often when we are considering such matters of concern to school health workers as procedures, forms, and the allocation of our time. One way of examining the meaning of behaviour in individual clinical problems is by reviewing its development, dynamically, by longitudinal section. Perhaps looking at some outstanding points in the history of school health work might help us with some of our perplexities. The "dynamic" method of study might help us to gain insight into the problems of adjustment to environment and in the solution of internal conflicts when applied to an organization just as it does when used to throw light on the meaning of a patient's symptoms.

Interest in the health supervision of school children in Europe began to appear in the 19th century. The first well-defined plan was introduced in Brussels in 1874. The first scheme in North America was in Boston in 1894. The primary objective of these early efforts was to control infectious diseases. Inspection by a physician was the method—"school medical inspector" is still an official title. This early work was, one surmises, motivated by fear; the effort was to exclude the source of the danger that threatened the mass.

Following the South African war there was considerable alarm in England because of the large numbers of unfit men amongst those who had offered to enlist. In 1907 medical inspection in England and Wales was extended to include complete physical examination of all school children on a nation-wide scale. Society's desire to protect itself was still being expressed but now attention was focused on the need for a reserve of manpower for the armed services. How much of the subsequent emphasis on posture and physical training goes back to that martial bias?

Medical attention was started in the Vancouver schools in 1907 with one medical officer; in 1910 the first school nurse was appointed. Conditions at that time may be judged by the fact that one general inspection of about 700 pupils revealed 91 cases of head lice. (By 1924 Dr. Harold White, the senior school medical officer of that time in Vancouver, reported that only 186 cases were found in more than 20,000 children. Dr. White said, "This one item

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will show the improvement in cleanliness in children in the past 14 years." Last year there were 31 children with head lice in an enrolment of 47,000.)

As a result of his experience in examining school children, Dr. Brydon-Jack, Vancouver's second school medical officer, became interested in the plight of the mentally defective. Due to his influence, the School Board opened an auxiliary class in March 1911 for fifteen pupils whom he selected. In the following October a second class was organized. It was from these two classes that the present system of special classes developed. In this case a "school doctor" went beyond his "inspector's" function to initiate the sort of specialized teaching that is still possibly our most extensively effective mental hygiene procedure. It was in 1909 that the National Committee for Mental Hygiene was founded, and in 1910 that the Binet-Simon test was introduced to this continent by Goddard.

Dr. Brydon-Jack in 1917 advocated that where there was a well-organized, comprehensive organization, child hygiene should be under the control of one authority because, he pointed out, the pre-school child's health and supervision was so important. The plan of having the school health service as a part of the public health service was not introduced in Vancouver until 1936. In 1917 also, Dr. Brydon-Jack gave this opinion: "The work up until now has rightly been called school medical inspection. From now on what is needed is not school medical inspection but school medical service. Such a service is concerned with the detection of physical defects and the more important work, that of obtaining treatment for the conditions found." He also emphasized that the control of contagious and infectious diseases—the hygiene of the home, proper lighting, heating and ventilation of the schools, adjustable seats, the curriculum, proper size reading type, the character of writing materials, school lunches, and regular exercises— were factors the school medical service must have constantly in mind.

Following the interest in the control of infectious diseases, general sanitation, extra nutrition and assistance for needy children, the major consideration became the detection of early defects and attempts to get them corrected.

Dr. White in 1925 said: "Early in the history of medical inspection, it was found that results secured through postcard notification alone were very poor. Realizing this, the authorities turned to the nurses, and the follow-up system is the result. Failure to provide treatment for children usually indicates ignorance, indifference, carelessness, or financial inability on the part of the parents. By home visiting, nurses discover the reasons for lack of treatment and so are able to deal with the cases. Home visits afford the nurses many opportunities for teaching health and hygiene. In many ways our nurses are the social workers for the schools. They have a knowledge of home conditions not available to anyother school worker. It has often been truly said that a nurse is the link between the home and the school." It seems that a great deal of our present system of record-keeping and reporting is related to this phase. The effectiveness of the work was judged by the number of defects that were treated. The system can lead to the strange conclusion that a child with an artificial eye, or limb, has been cured of his defect.

Throughout Dr. White's work and in many of his reports he showed that

his interest went much beyond the discovery of defects and the seeking of treatment, and he consistently stressed the educational value of the medical examinations and of the nurses' visits. Thus, along with the changes in the main preoccupations of the school health services, we see the gradual development of some of the purposes that we now regard as most important.

Another example of the long background of some questions that are still problems to us is seen in a 1916 report of the Sex Hygiene Committee of the Vancouver Medical Association which had been formed in 1915. "With such correspondence as has been had, it did not take long to ascertain that the whole subject was a veritable welter of confusion, opinions differing as to whether the subject should be taught at all, and if so, to whom and in what manner." In 1911, the committee had recommended the teaching of "what is called, for want of a better term, sex hygiene," to high-school pupils, and the doctors had been brash enough to engage to do the teaching. By 1916, the doctors had come to the conclusion that it was "impossible to deal adequately with this subject by a course of lectures delivered by a physician at the close of the high-school course." They thought that "the proper way of teaching the subject is by means of and from the standpoint of biology. The child's mind from the earliest possible age should be gradually trained along this line so that the whole subject will gradually unfold itself in a natural manner. We propose that this teaching should be made part of the school curriculum—that the term Sex Hygiene or Social Hygiene shall be entirely excluded during the course." In recent consideration of the subject we really have not advanced beyond that opinion.

We forget quickly some of the chief problems of history, even when it is not so very far behind us: in the twenties, diphtheria and smallpox were continual threats. In the fall months of 1929, 58 cases and 90 carriers of diphtheria were reported in the Vancouver schools and in 1924, 1925, and 1926 there were 215 cases of smallpox. Dr. White was able to report, with some complacency, that none of the cases had been successfully vaccinated.

The distribution of iodine-containing tablets called chocolate pills was one of the big administrative tasks during the 1930's—until 1951, in fact, when it became unnecessary because national law required that iodine be added to table salt. Here is an example, second to that supplied by the special classes for dull children, in which a hygienic principle was recognized by medicine, the procedure of its application developed, and its administration passed over to other hands.

In 1936 the Metropolitan Health Committee health service came into being and Dr. Stewart Murray joined the staff. He was to include in his activities leadership in the field of mental hygiene. He had to give up active clinical mental hygiene work on becoming, first, assistant, then Senior Medical Health Officer, but he has never wavered in his efforts to promote the assimilation of mental hygiene by public health.

These few references to the path by which we have arrived at our present position may help us to decide what our course should be. Efforts to control epidemic diseases in the 19th century were the reason for the first school health services. The method was detection and exclusion of cases and later

enforcement of vaccination laws. With the beginning of this century came an interest in promotion of physical fitness, with a good deal of reliance placed on fresh air, exercise and general sanitation. Finding physical defects and obtaining early treatment for them was the next step.

Up to that point the medical task was an easily defined one, the schools needed only to agree with its methods and aims. There was not much overlapping of the jobs of the teacher and the doctor. In a general way the doctor's relation with the teacher was similar to his relation with the patient in the practice of clinical medicine; the patient was supposed to be the passive recipient of the service the doctor provided—the bottle of medicine or the surgical operation.

By the end of, say, the first thirty years of this century experience in school health work, great advances in medical knowledge about health and disease, and a new interest in the nature of the doctor-patient relationship, had made it clear that fundamental changes in the pattern of school medical work were indicated. Proper nutrition, control of food and water supplies, and active immunization against diseases other than smallpox produced spectacular results in the preventing of disease. Extension, by education, to the children and to the people in their homes, became the obvious need. This was getting away from the old model of the doctor and his patient, but was not out of line with the concept of treatment associated with the interest in psychomatic medicine. A programme that extended far byond the school was necessary to make the available knowledge effective. School health work was going to be more effective and probably more economical if it began its work at birth and if its working relationships with the public health services of the community were as intimate as possible.

The second major conclusion was that a programme based on education had many advantages over one based on authority. Compulsory vaccination had raised a great force of opponents; the campaign in favor of the use of toxoid to prevent diphtheria, relying on education rather than compulsion, had achieved satisfactory results without nearly as much opposition. It is difficult to enforce a law requiring that babies be given vitamins D and C, and there must be favorable public opinion before a community can have compulsory pasteurization, or chlorination, or fluoridation or iodization.

When health education became the main purpose of school health work the doctor could no longer do the job alone. He required the active support of teachers and he had to have nurses who were partners and not just messengers and inspectors.

Since about 1930, there have been changes in medical thinking as well as in school health work. There has been a shift, in some ways a shift back, to a more comprehensive or holistic field of reference. Emotional and social factors have regained the importance that was attached to them before the startling achievements of chemistry and bacteriology distracted us from the truth that patients are human beings.

Now it is not good enough to weigh a thin child and put him to bed if we find that he has radiograph evidence of tuberculosis. It is not enough for the

doctor to diagnose St. Vitus dance and put a child in a fresh-air class room and stop his physical exercises. It is not necessarily wise for a teacher to arrive at a diagnosis of laziness and begin treatment without knowing the physical, emotional and social factors. It is not always helpful to get cross with a parent for what looks like neglect of a child. The parents' personality and circumstances must be known. Methods of diagnosis and treatment, the field of reference, have changed, and new procedures are necessary.

When one attemps to find an instrument or a device to measure what we are doing in a school health service, one runs into difficulty at once. We are making an attempt in a small area of our service to devise some way of looking critically at our program.

To date, we have not been too successful, but from what we have observed so far in current study of the reasons why children in elementary classes seek out the health services, it is our opinion that there is no consistency about the manner in which children are referred. In the schools which we are studying, public health nurses are in attendance three mornings a week, the rest of their week being spent in a generalized public health nursing service.

It was found that on these mornings some teachers referred almost no children to the health service and some sent fairly large numbers. By and large the nurses felt the cases referred were legitimate ones, but the study showed that relatively few cases were referred for other than a physical reason. Quite often the ostensible "physical" complaint only thinly concealed an emotional problem.

Is there a lack of awareness on the part of teachers that emotional problems are a cause and a part of poor health? Or is it that there is a lack of recognition that the nurse has a part to play in mental health work?

One wonders what should be the optimum number of children referred from a class of fourteen-year-olds, of six-year olds.

One begins to wonder, too, in what guise a health service in school is seen by the people it tries to serve. Does its effective use depend upon the understanding of the teacher about the place of the health service, the administrative ability of the principal, the relationship of the nurse with children or the policy laid down by the school health service?

The teacher's daily observation gives her a wealth of knowledge about each child. This knowledge should be available to the health service and the public nurse is the natural recipient. Could the nurse not be considered the "general practitioner" in the field of health among all the specialists—doctors, social workers, psychiatrists, psychologists, nutritionists, dentists—with a little knowledge of each specialty, but with the knowledge, too, that she is not competent to practice independently in any of the fields. She has her own specialty—that of being able to see the family in the home environment; to know the mother in her own setting when she is not on guard, to see the interplay of personalities among members of the family and to bring this knowledge, organized by her clinical skill in sorting out problems of health and illness, to the conference table? Do most teachers accord the nurse this sort of role, or do they see her still as a person who is interested in only "phys-

ical" aspects of health? When they have the latter idea they not only limit the health services' field of useful work, but they undermine the concept of the unity of mind and body.

If they are to do their best in the interests of the health of the people, following the trend towards a more comprehensive type of medicine, school health services must go farther than they have, in their efforts to follow the ways of cooperation and communication. Twenty-five years ago the teacher's job and the school health worker's job were fairly well defined. Both of them had more confidence in the efficiency of telling their students or patients just what to do than they now have. The tasks of teachers and health workers overlap and the most important problem of our current phase of development in school health work is to learn to understand each other's language, to combine our efforts and to augment each other's efforts.

Teachers, administrators, nurses, social workers, psychologists and physicians need to improve their use of a new technique if they are to work together most effectively. The "multi-disciplinary approach" is not, or should not be, a number of people each seeking independently, or sometimes competitively, the answer and the kudos. It should certainly not be a matter of each one jealously guarding his own prerogatives and suspiciously challenging his associates. It should be rather real team-work. Now if a team is to be effective it must train as a team and plan as a team. We would suggest that our most pressing problem in school health work, at present, is just that. We are trained for our individual roles, but we haven't much training in team-work. Goodwill does make up for a great deal of the lack of training, but we could do better by consciously facing this aspect of our work. Participating, in the full sense of the word, in conferences and discussions seems to be the method by which we can come to an understanding of our own and each other's insecurities and defenses. This is time-consuming and one hears the cry—let's get on with the job without so much talking, let's be practical, but let us not confuse "practical" with "shortsighted".

As a starting point, those responsible for administration and the allotment of teachers' and nurses' time would have to agree to the idea that provision be made in schedules for conferences. Time spent in discussion between teachers and nurses should be regarded as being used just as constructively as if it were time spent by the teacher in her classroom or by the nurse visiting the home.

Medical Records and Statistics in Hospitals

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THERE are many problems inherent in the field of medical records in Canada. The National Cancer Institute of Canada very kindly made it possible for a survey to be conducted on behalf of the Canadian Association of Medical Record Librarians during the past year and centres from Victoria to Charlottetown were visited. I think the findings may be of interest to you. Before setting them forth, however, it might be of interest to fill in the background of the picture by giving briefly some details concerning the Canadian Association of Medical Record Librarians itself.

Canadian Association of Medical Record Librarians

Early in 1935 the need for an official body in the field of medical records and for the training of medical record librarians was first considered by a group of representatives of five Ontario hospitals. From this resulted the formation of the Ontario Association of Medical Record Librarians and from this, in turn, evolved the Canadian Association in 1942. This latter body received its charter in 1949. The main objective of this Association, and one upon which all others hinge, is to elevate the standards of clinical records in hospitals. There are three provincial associations—British Columbia, Manitoba and Ontario.

One need recognized in 1935, as it is today, was for schools for the training of medical record librarians, with the result that two centres were approved as desirable for training schools. In the intervening years this number has been augmented and at the present time we have seven approved schools.

The training provided consists of not less than 52 weeks of practical hospital experience and theoretical instruction. Formal lectures are given in the basic medical sciences and practical training involves all activities associated with the care of medical records. The entrance requirements to our schools are as follows. (1) All students admitted to the course must have senior matriculation *or* diploma or graduation from an accredited school of nursing *or* normal school certificate. (2) They should be proficient in shorthand and typing. (3) They must be at least 18 years of age.

The regulations governing registration are:

1. Minimum age of 19 years.
2. Education:

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(*a*) Senior matriculation or the equivalent educational standing in the various provinces, *or* graduation from a school of nursing recognized by a provincial board of nurse examiners, *or* normal school certificate.

(*b*) At least 12 months' training in an approved school for medical record librarians, or successful completion of the two-year extension course and a minimum of three years' active work in a medical record department (two of the three years being concurrent with the extension course work), or five years' experience in a hospital during which time the applicant has been actively engaged in medical record library work.

(*c*) Reasonable efficiency in shorthand and typewriting.

(*d*) Those who cannot apply under the above regulations may make application to the Board of Registration for special consideration.

3. Enrolment in one of the classes of membership of our Association.

An extension course for medical record personnel unable to attend the formal one-year course of instruction was initiated last autumn by the Canadian Hospital Association conjointly with the Canadian Association of Medical Record Librarians and with the generous financial assistance of the W. H. Kellogg Foundation. For enrolment applicants should have junior matriculation or equivalent standing. The course extends over two years, consisting of two 34-week "home study" or winter sessions and two four-week "intramural" or summer sessions at a hospital approved for the purpose. As mentioned, successful completion of the two years counts towards eligibility to write the examination of the Canadian Association of Medical Record Librarians for registration, provided the individual has honour matriculation or equivalent status. The Canadian Association awards a certificate upon the successful completion of each of the two years of the course. There are thirty-one people enrolled in this course at the present time.

Survey

And now let me tell you something of what was found on my trip across Canada. Fifty-eight hospitals in nine of our ten provinces were visited as well as people in each province connected with health matters.

Certain broad patterns in regard to medical record problems soon became apparent. These appeared valid from province to province and disregarded size or situation of centres.

Level of Record-Keeping

The first and perhaps most important of these was that the average level of medical records across Canada seems regrettably low. There are centres where excellent records are kept but these represent peaks of achievement and not the general level. As might be expected, in the smaller and/or more remote hospitals the interest necessary for truly good records was apparently lacking and the coding of disease in accordance with the Standard Nomenclature of Disease was not carried out in a high percentage of cases. It was found, too, that medical records in many of our larger hospitals could be graded only as fair to poor. In one of our larger general hospitals, for example, there was no coding

of disease or operations and in another, even larger, such coding as is performed is so poorly done as to be considered as of no value by the hospital administrator. In view of this low average level the query arises as to how it may be possible to compile valid statistics on a national basis from the medical records as presently maintained across Canada.

Appreciation of the Role of Medical Records

Why does this situation exist? There are two main reasons, I believe. First, there is a generally insufficient appreciation of the importance and significance of the part played by medical records in the health scene. Without good medical records it is impossible to properly assess the incidence and prevalence of diseases, or the effectiveness of treatment; nor can research be effectively carried out. The medical record is of prime importance to the health field, to the hospital and, last but by no means least, to the patient. It is not too strong to say that a hospital stands or falls in its medical records, and under the hospital accreditation programme this will become increasingly evident. Medical science has advanced notably even within the past decade and it is felt that medical record keeping has not kept pace. This is in part the fault of all of us but it applies particularly to hospital administrators and medical staffs.

The Hospital Administrator

When speaking with both hospital administrators and medical record staffs it was apparent that in many cases there is a lack of appreciation on the part of the hospital administrator of the importance and value of medical records or the problems of the medical record librarian. Too often the medical record librarian is looked upon more as a clerk than as the head of a department which contributes materially to the status of the hospital, the evaluation of treatment, and the Canadian health scene as a whole. The picture is not all black, of course, and many were most alive to and interested in medical record problems, Much, however, might be done in the education of the hospital administrator in the importance of medical records and medical records personnel.

Medical Staff

Then, too, the record librarian suffers frequently from lack of co-operation on the part of the medical staff. One of the primary difficulties here is lack of knowledge of the Standard Classified Nomenclature of Diseases and Operations. This hampers the efficiency of any medical record department and often results in the incorporation in the patient's chart of diagnoses widely at variance with this nomenclature. This makes comparability of data difficult. In many instances symptoms rather than the disease are recorded. It is felt that if some stress were laid upon the importance of correct diagnoses according to this nomenclature at the student level, it would be of inestimable value. Thus if a medical man was indoctrinated at the medical school level and at the interne level, he should, when a staff man, have some grasp of the importance of such "paper work". This should result in more exact data being recorded and thus permit more exact statistical analyses.

Shortage of Personnel

The second factor contributing to the low standard of medical record keeping is a very serious shortage of properly trained and qualified personnel.

One registered record librarian for each 100 beds is regarded by the Canadian Association of Medical Record Librarians as being requisite for good record keeping in general hospitals. It is felt that for mental institutions and sanatoria one qualified librarian for each 200 beds would be adequate. On this basis, for our Canadian hospitals of over 100 beds from coast to coast, there is an immediate need for 957 registered record librarians, to say nothing of the assistants for whom a certain level of training would be desirable. This figure does not take into consideration hospitals of less than 100 beds, not because the need for qualified personnel is less here than for larger institutions but simply because it is more difficult to assess and it is desired to lean towards the conservative in our thinking. Nor does this estimate include the various treatment and research centres where qualified personnel are also required. It is probable that an additional 50 personnel could presently be utilized to advantage in such places, thus bringing the total of qualified personnel needed for good medical record keeping to roughly 1,000. It is estimated that another 175 trained librarians will be needed within the next five years.

At the present time, to the best of our knowledge, there are not more than 165 registered record librarians actively engaged in the keeping of medical records.

This shortage of qualified personnel appears to be due mainly to insufficient facilities for training and to lack of attraction to the field. By the latter is meant insufficient publicity, poor salaries and poor working conditions.

Training

Several hospital administrators across Canada evinced their interest in the establishment of schools but various obstacles seem to stand in the way of such schools coming into being. The lack of qualified directors is a serious deterrent and many hospitals which might consider the establishment of such schools are not in a position to do so for financial reasons. It is hoped therefore that governmental assistance may be considered and made available to hospitals desiring to establish training schools for medical record librarians. At the present time, even if each of the seven approved schools had a full student complement and each student graduated, the maximum number to graduate in one year could only be 46. This year there is an enrolment of 32. The present training programme does not much more than take care of necessary replacements in the field.

After 1955 registration with the Canadian Association of Medical Record Librarians will be on the basis of graduation from an approved school or the successful completion of the extension course. Registration will no longer be possible on the basis of five years' experience. Because of the extreme shortage of trained personnel, the general feeling seemed to exist that this regulation should be held in abeyance for the time being and that, for those people who have or will become registered on the basis of experience, courses of training should be provided to bring them to the desired level of competence. Thus, it

was considered, another source of supply might be tapped without undue lowering of standards.

An increasing number of hospitals require record librarians who might be termed "administrative librarians". By this is meant that their time would be fully engaged with policy matters, reports, meetings and so forth at a higher level than in positions where the librarian is more intimately concerned with the actual details of record keeping. Then too, many hospitals and centres are giving thought to the possible appointment of a statistician to their staffs and, in some instances, to the combination of these positions. For these reasons, it is felt that training at the university level is becoming indicated.

There is another facet to the training problem and this is at the other end of the scale. Many individuals engaged in medical record work have not attained junior matriculation standing. Training to equip them to be medical record clerks, it is felt, would be very worthwhile in the over-all picture.

Publicity

Another factor contributing to the shortage of medical record librarians is the lack of knowledge regarding this profession on the part of the general public and the potential workers themselves. When asked, most medical record personnel stated that they had known nothing of this field and had more or less "fallen into it". Wider publicity regarding medical record work seems to be indicated at the high school and university levels.

Salaries

Salaries in the medical record field are, on the whole, relatively low and are not conducive to attracting young people into this field. Some of this is undeniably due to the fact that the medical record librarian herself is often not considered on a level with other hospital department heads, either in prestige or salary. With greater consciousness of the importance of medical records in the health picture, this difficulty may be overcome and a strenuous effort should be made on the part of all those interested in medical records to promote such greater consciousness. In several places visited medical record personnel were receiving less than ward maids. A salary scale for medical records personnel does not exist at the present time and is badly needed. Many hospital administrators have asked for such a scale, and thus a contributing factor to the present low salaries would appear to be a lack of knowledge regarding adequate remuneration.

Space and Equipment

There is one last finding which at the present time seriously hampers the medical records programme. This is a pronounced lack of necessary space and equipment. In general, the working conditions for medical record librarians leave much to be desired. The medical record department is too often located in space designed for some other purpose, with consequent poor location, and equipment is often antiquated. These conditions will certainly be changed when greater interest is taken in this field, and changes are already in progress in many centres. In a large number of new hospitals adequate space and equipment are being allocated to the medical record department and many

presently existing hospitals are acceptably looking after this department through reconstruction or additions and plans for proper equipment.

It will be seen, then, that the existing situation is serious if the level of medical records is to be raised. Let us look at what may be done to improve the situation. The following recommendations, as will be noted, are broad and general in nature. No attempt has been made to present here the more specific aspects and suggestions.

Recommendations

1. That an appreciation of the role of medical records in the health field generally, and in particular on the part of hospital administrators and medical staffs, be stimulated by every possible means.
2. And to this end that consideration be given to the indoctrination of the medical student in the fundamentals of the Standard Classified Nomenclature of Diseases and Operations.
3. That steps be taken to alleviate the present shortage of qualified medical record librarians by stepping up the training programme.
4. That governmental assistance be considered for hospitals to facilitate the establishment of training schools for medical record librarians.
5. That a vigorous public relations programme be instigated, including an intensive publicizing at the high school and university levels of the profession of medical record librarian.
6. That consideration be given to provision of better salaries for medical record librarians.
7. That hospital administrators be encouraged to provide adequate working facilities.

Conclusion

From the foregoing it will be appreciated that there is much to be done in the field of medical records. The findings I have mentioned are presently being considered by the Canadian Association of Medical Record Librarians but it is only through the efforts of all of us interested in the Canadian health scene that the challenge which faces us today can be met and medical records in Canada can be brought to a higher level.

Highlights of Public Health Nursing in Northern Europe

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LAST autumn it was my privilege to spend three months abroad on a World Health Organization fellowship. The purpose of this period of observation was to help me prepare myself for the post I now hold. In this connection it seemed advisable to try to do two things: (1) to see how nurses, in similar positions in the countries visited, carry on their duties; and (2) to obtain a quick overview of present conditions in nursing and of the trends in nursing education, public health nursing, and occupational nursing. My time in the countries visited was brief—two weeks each in England, Norway, Sweden, Finland, Denmark and Holland. Thus, my program in each country was extremely concentrated and varied, and the observations I share with you today represent highlighted impressions of one field only, public health nursing.

England

As far as the National Health Service is concerned, this appears to be shaking down nicely, and almost everyone I talked with seems fairly happy about it. The impression I received could perhaps be best summed up in a remark of Sir Charles Lane, Principal Regional Medical Officer, Cambridge: "The Health Service is a great success. There is, of course, room for improvement, especially in out-patient, specialist and dental services, but one just can't visualize the country without it now."

I was interested in learning how the Queen's Institute of District Nursing is adjusting to its new situation as part of the Health Service. I gathered that the position has not been altogether easy. The Local Authority is, of course, the responsible body. One section of the National Health Service Act deals with domiciliary care. A handful of Local Authorities run a domiciliary nursing service themselves, but the majority have asked the Queen's Institute to do it for them. Under the new set-up the Local Authority assumes 90% of the cost, and the Queen's Institute the balance. With rising costs it is increasingly difficult for the Institute to meet this 10%. I was told that, on the whole, Queen's is rather relieved that the small local committees are disbanded. The present county set-up means more economical and more efficient management.

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Nurses can be shifted more readily with reference to local need. With the happy British knack for compromise, they have come up with the term "membership"; a Local Authority "comes into membership" with Queen's. While the responsibility for management of the domiciliary service now rests with the Local Authority, training is still the prerogative of Queen's.

Recently the Minister of Health set up a Working Party to study the requirements of training for district nursing. Certain changes may come about as a result of this step. In some counties the Queen's nurses are doing midwifery, general nursing and health visiting; in others, midwifery and health visiting. All superintendents and supervisors of Queen's are required to be qualified in all three areas—as a midwife, as a Health Visitor, and as a Queen's nurse. (This means three years' general training as a State Registered Nurse plus one year of midwifery and nine months of training as a Health Visitor, and either four or six months' training as a Queen's nurse; the length of the latter qualification is dependent on the degree of experience possessed by the State Registered Nurse.)

While in England I saw something of the Leicester Home Help Plan. A staff of 260 women, employed under the Leicester Child and Maternal Welfare Division, is available for help in the home where there has been a confinement or illness.

Under the National Health Scheme there is provision for the employment of this type of worker, but not many Local Authorities have taken advantage of it as yet. The plan appears to be working quite well in Leicester and the workers seem a well-trained, kindly group with a sense of vocation.

Of the Home Care Plan in Cambridge, modelled after the Montefiore Plan in New York, I would say simply that in Cambridge the emphasis would appear to be more on the *release of beds*, rather than on *what is the best plan for the patient*. Also, owing to a shortage of beds for chronic illness, and long waiting lists, it is not always possible to secure readmission to hospital (which is one of the strengths of the Montefiore Plan).

Time does not permit me to speak of some of the other interesting things I saw in Britain. I must pass on now to a brief glance at public health nursing in Norway.

Norway

Norway, like Denmark, Holland and Finland, is still recovering from the effects of the war. Basic nursing education is in process of reorganization. In addition, a serious attempt is being made to provide an adequate public health organization.

Larger than Great Britain, but with a population of only 3,000,000, Norway is divided into 20 provinces containing 400 districts. It is hoped that eventually each district will have a full-time medical officer of health and one to two public health nurses in a ratio of one nurse to 3,000–4,000 population. This plan is just getting under way. It is estimated that from 800 to 1,000 public health nurses will be required to give this coverage; at present there are 300. A generalized program, including bedside nursing, is planned for the rural areas.

I travelled extensively through one of the northern provinces, and gained an insight into the difficulties encountered in these sparsely settled areas, so similar, in parts, to our own Canadian scene, and with similar problems.

Since 1947 there has been, at Oslo, a post-graduate school for the preparation of public health nurses. Prior to this, from 1925, the Norwegian Nurses' Association gave short courses in public health nursing. At the present time, about 50 public health nurses are being graduated from the new school each year. It is hoped that the number may be increased shortly to 100.

There is talk, too, of a central postgraduate school for the whole of Scandinavia. There is presently no provision for advanced work for nurses in Scandinavia—either in public health nursing or in teaching or administration. The proposed school would combine basic and advanced work in these fields.

Founded in 1896 to provide medical supplies in time of war, the Norwegian Women's Public Health Association now pioneers in various health fields, turning over its projects to the official body when their usefulness has been demonstrated. Cancer, tuberculosis, and rheumatism have felt the enthusiastic impact of this vital group. The Norwegian Women's Public Health Association also runs four nursing schools, one of which is an independent school with a sound progressive program.

At Ulleval Hospital in Oslo a course of 20 hours in elementary nursing is given to the medical students by one of the School of Nursing instructors. The medical students are taught bed-making, bed baths, and the giving of hypodermics and enemas. The course consists of demonstrations and practice. Many of these medical students will later practise in remote areas without an assisting nurse, and it is felt advisable for them to have some acquaintance with the simpler techniques of nursing.

In Norway, as in all of the Scandinavian countries, fewer infants are being delivered in the home. This is bringing about a change in the time-honoured position of the midwife. The trend now is for midwives to have at least two years of general nursing training, with midwifery added as a specialist training of 12 to 18 months. In rural areas it is expected that the emerging pattern will be public health nurse-midwife, doing a generalized service.

The Oslo Department of Health has an ideal teaching area contiguous to it. The Municipality of Acker, a young, growing community comprising 19 districts and an area of 170 square miles, has a veritable cross-section of population—farming, industrial—new housing, etc.

With regard to school health service I was told that in schools of over 250 pupils a teacher, specially suited to this type of work, is detailed by the principal to assist the nurse. This teacher carries a lighter teaching load; she is usually one of the older ones and, in addition, has shown a special interest in health and social aspects. After being carefully briefed by the school doctor, nurse and principal, she is able to relieve the nurse of many routine duties in the school health program.

The usual pattern of occupational nursing in Norway is a part-time physician and a full-time nurse. The Norwegian Nurses' Association gives a four-months' postgraduate course in occupational nursing. Industry secures its nurses from the graduates of these courses. An industry can employ a non-qualified nurse

if it wishes, but as the Norwegian Nurses' Association controls salaries, this is not likely to occur.

Professor Natvig, of the State Institute of Public Health, exploded some clichés about the value of a health service in industry. How frequently one hears it said: "A good health service cuts down absenteeism." Says Dr. Natvig: "No. It increases absenteeism, but it saves the worker for industry."

Sweden

Since 1920 Local Authorities and private associations in Sweden have employed certificated domestic helpers, especially trained in housework and the care of children, to take the place of the housewife and to assume her duties in the home in case of sickness and childbirth. In a country considered to be an outstanding example of the Welfare State, it is interesting to note that this Domestic Help plan started under voluntary auspices, notably the Red Cross. In 1943 the scheme was taken over by the Government, to be supported jointly by the State and by county councils. Last year (1953), 3,100 Domestic Helpers were trained by the two training centres of Stockholm and Göteborg. The hope is that soon there will be sufficient numbers, not only to be of immediate assistance in crises in the home, but also to lend a helping hand as holiday deputies for tired housewives, and to assist old people and single people living alone who become ill and unable to cope with cooking meals and cleaning their living quarters.

There are two types of training: (1) a 15-month course at special schools for girls from 20–25 (there are 14 of these schools) and (2) a 3-months' course for older women with at least five years' experience in housework and the care of children. The 1,800-hour curriculum includes nutrition, cooking, baking, canning, sewing, mending, child care, psychology, washing, cleaning, milking (in rural areas), home nursing, hygiene, psychology, citizenship and singing. The qualifications are good health, adaptability, an equable and kindly disposition, and the ability to inspire confidence and an atmosphere of tranquility in the home. The staff of the schools consists of a teacher of domestic science, a teacher of sewing, a nurse, a doctor, a child-care teacher, a psychologist and a social worker.

Ten months are spent at the school and five months in practice in institutions (two months maternity, two months child care, one month chronic illness). The salary is from 6,000–7,000 S.K. (about $120) a month. A "Wilderness bonus" is paid for work on outlying areas (up to 900 S.K. a year). A pension is provided at age 60 and there is provision also for holidays and sick leave. Free meals are supplied at the place of work, and quite frequently free housing.

The plan is administered by the Municipal Domestic Assistance Board, and supervision is carried out by the Royal Social Board. Those who are able to pay do so, but the fee is quite reasonable (equivalent to $3.00 a day). The service is free to families of limited income.

County Councils are now so interested that they have given free space and facilities in Schools. Also, if a Local Authority employs Domestic Helpers, it receives a grant.

In Göteborg (population 300,000) a study has been made to determine the need of the ageing population for this type of service. It was found that many old people could benefit by part-time Domestic Helpers. It was decided that it would not be economical to use the graduates of the 15-month course for this service, but to recruit the older woman who could give the service on an hourly basis. At present this is working out very well.

I was greatly impressed with this scheme. There is careful selection of applicants, a sensible and thorough training, good working conditions and prestige, and a large and growing need to be met. It is not nursing, yet we as nurses cannot fail to be interested in its possibilities, and perhaps indulge in a bit of wishful thinking that we in Canada might have as useful an adjunct in our work.

Finland

The Rockefeller Foundation has been interested in public health in Finland for a number of years. Certain plans were interrupted during the war, but now Rockefeller funds are once again assisting in the setting up of various types of public health projects. One of these is an excellent teaching field in Uusiman Province.

The philosophy in Finland concerning demonstration teaching areas interested me. The key word is "natural". Have the demonstration areas as natural, as typical of the country as a whole, as possible, in order that the lessons learned there by young public health nurses and health officers may be realistically applied elsewhere. Apparently their former teaching area in Helsinki was too artificial.

Finland is divided into "communes", of which there are 500. These vary in population from 300–40,000; the average size is 2,000–4,000.

It is established by law that there should be one public health nurse for each initial 4,000 population; e.g., if the population of a commune were 500, there would be one public health nurse; and for a population of 4,050 or 4,200, there would be two public health nurses. At present the shortage of public health nurses in the country numbers 200. The State pays 75% of the salary of a public health nurse.

In the communes there is close cooperation between the midwife and the public health nurse. Frequently both share the same living accommodation in a "Health House", which combines living accommodation and clinic facilities.

In rural areas where mothers find it a hardship to bring their children great distances to a clinic, the doctor and the public health nurse go to them at stated intervals. In this way "sub-centres" are set up in addition to the main centre. These serve the commune very well.

I spent an interesting day visiting throughout a rural province with the communal doctor. This charming woman, the wife of a psychiatrist on the staff of the Children's Castle in Helsinki, has three small children of her own. The day I went around with her we were privileged to have a car, but this is not the doctor's usual method of transport. They have a car, but her husband uses it to come and go from his work in Helsinki. His wife, with a large territory to cover, makes her rounds by bus or train or on foot. In addition to giving service in various centres and sub-centres, the communal doctor is responsible for the

supervision of all health work in her commune—old people's homes, schools, tuberculosis sanatoria, communicable disease hospitals, and convalescent homes. I simply did not see how she managed it, but obviously she was doing a good job. Naturally she had good domestic help in her home. Also, she is young and possessed of that vigour and drive which seem characteristic of so many of the Finns.

I was told that nowhere in the world are the services of midwives used to such a degree as in Finland (where there are 1,500 midwives—one to every 5,000 of the population). Nurses get very inadequate training and experience in maternity work. There is agreement in principle that all midwives should be nurses, but it is not anticipated that this change will take place in the foreseeable future. At present the training for non-nurse midwives is two years. For third-year nursing students and for graduate nurses, the training is 13 months. About 25% of midwives are nurses.

Public health nurses receive their training at the College of Nursing in Helsinki. This is a very active institution, State-supported. Not only does it give postgraduate courses in public health nursing, teaching and supervision, supervision in public health nursing, industrial nursing, ward administration and supervision, midwifery, and medical social work, but it operates two basic nursing schools—one Finnish and one Swedish. These basic nursing schools are Central Schools—for the preliminary period of 4 months. Students come to the basic nursing schools from all over the country for the preliminary period.

The College of Nursing, as well as two other State Schools of Nursing, have successfully demonstrated the integration of the public health and social approach into the undergraduate course.

The position of nurses as medical social workers in Finland is an interesting one. To meet the need, the College of Nursing provided instruction in medical social work, first offering short courses later lengthened to one academic year.

Since 1940 there has been a School of Social Work in the University of Helsinki, but it does not teach the case-work method. Most of the instruction is directed to an interpretation of social legislation. Thus, public health nurses are doing medical and psychiatric social work in a medical setting. If and when the School of Social Work reorganizes its course, the College will gladly relinquish the burden.

By law, in Finland all public health nurses and all midwives must take a a refresher course at least every ten years (in active practice usually every five years). Five courses a year are offered at the College. The Local Authority pays salary for six weeks, travel expenses and a living allowance while in Helsinki. From ten to twelve students are enrolled in each refresher course.

Denmark

In Denmark they are presently engaged in a comprehensive study of nursing education which was interrupted by the war.

In some countries war stimulated the progress of nursing, but this was not the case in occupied Denmark.

Denmark is an old democracy in which many ancient patterns still persist. The newer concept of public health nursing is just being developed. District nurses (not public-health trained), serve throughout the country, some being employed by Local Authorities and others by private institutions or Sickness Clubs. It is the hope that eventually the system will be reorganized and that a combined, generalized service may be set up. Some fear has been expressed that, if this happens, bedside nursing may take up too much of the public health nurse's time and preventive work be neglected.

The tuberculosis programme seems fairly adequate. There is a centre in each county, with physicians and nurses attached. Case finding is carried out vigorously and includes the use of mobile x-ray units and mass radiographs of the whole population at regular intervals. Costs are shared by the State, the community and the tuberculosis association. BCG vaccination before the end of the first year of life is nearly 100%.

Danish mothers are not "clinic-minded". All health-education work has to be done on a home-visit basis, which makes it expensive.

In Copenhagen and all provincial towns and cities, public health nurses engage in infant welfare work. In a few places (e.g., Aarhus) there is a combined programme.

If a community employs a public health nurse, the State pays half the salary. Some communities in Zeeland are interested; Jutland is more conservative, preferring to employ district nurses on the old pattern. The district nurses, not public-health trained, work by themselves, without supervision. Most of their work is bedside nursing. This pattern evolved because the Sickness Insurance plan stressed *care during illness*, with little or no emphasis on prevention.

The University School of Nursing at Aarhus gives postgraduate training in public health nursing, teaching in schools of nursing, administration in nursing service and nursing education.

The faculty is keen, well-trained (in the U.S.A. and/or Canada), and alert to the need for broadening the programme of the School. A long-range plan is being worked out whereby, in selected areas, well-trained public health nurses will gradually replace the district nurses, and a more adequate service be offered the population.

In Denmark the family physician has been kept very much in the picture. The family has the same doctor both for sickness and health. Where the doctor has a modern public health outlook, this works out very well. Many of the older men, I was told, are not interested in the preventive aspects.

On the other hand, many public health practices considered new in other countries have been accepted for many years in Denmark. One feels unmistakably here the influence of true democracy, and that the nation, as a homogeneous unit, is moving slowly but steadily in a progressive direction.

Holland

In Holland I was greatly intrigued by the various "Cross" Societies. The Green Cross, which is the largest, is non-denominational; the White-Yellow Cross is Roman Catholic; the Orange-Green is Protestant.

These voluntary organizations are over 50 years old and stemmed from the health needs of the people in small communities. District nursing in Holland, for instance, began in this way. All of them started as small local groups. The Green Cross has now provincial organizations and, as well, a national headquarters, but the *local* Green Cross is, to all intents and purposes, autonomous. There are about 1,000 local Green Cross Societies, covering 1,000,000 families or 4,000,000 persons. They pay a family fee of 5 Guilders a year (about $1.35). Local communities and the State subsidize the balance.

Green Cross employs only public-health trained nurses. The State pays one third of their salary. The ratio aimed at is one public health nurse to every 500 families in rural areas and one public health nurse to every 700 families in urban areas.

The Local Authority supplies the nurse with a bicycle. In some areas Health Centres have been built, with living quarters for the nurse. The nurse is responsible to a local board of management.

The expressed philosophy of Green Cross is that bedside nursing is the bedrock of public health nursing. There should not be more than one nurse going into a home. Thus, the program is completely generalized.

Green Cross also engages in specialties, e.g., tuberculosis, and operates some very fine sanatoria. Rheumatism, venereal disease and child welfare are also special projects in some areas.

Green Cross conducts its own courses for the public health preparation of its nurses, providing two courses a year in four centres, ten and a half months in length. At first the Society paid the full cost of these courses, now they receive a State subsidy. Instruction is provided in pre- and post-hospital care of psychiatric patients, Green Cross does not require the nurse to serve with the organization after completion of her course, should she desire to proceed to other work.

In Holland there is no noticeable trend toward the hospitalization of maternity patients; 98% of births occur in the home. There is a shortage of hospital beds, but Dutch women prefer to be confined at home. I was informed that anaesthetics and/or forceps are very unusual, even for a first birth.

Midwives receive three years' training. They deliver the patient, and then the "Monthly Nurse" takes over. She visits the patient twice a day for ten days and gives the necessary care to mother and baby.

The "Monthly Nurse" has one year's training—3 months' theory and 9 months' practice under supervision. Her theory includes domestic training, although the majority have had this before enrolling as a "Monthly Nurse". In some circumstances she stays in the home for ten days, doing the cooking, washing and cleaning, as well as caring for mother and baby. The "Monthly Nurse" ranges in age from 20–40. Supervision is carried out either by the Director of the Training Centre or by Green Cross provincial nursing supervisors.

The cost to a family for the services of a "Monthly Nurse" for the full ten days (if they can pay) is 15–20 Guilders (about $5.00). The services of the doctor and the midwife are covered by sickness insurance (compulsory if the income is 5,000 Guilders or less, otherwise voluntary).

In conclusion I might leave with you several final impressions:

1. The warm feeling in these countries towards Canada and Canadians.

2. The knowledge many of these nurses have about nursing in Canada. "The Canadian Nurse" is highly thought of. They wanted information on the Structure Study, the Head Nurse Study, the Windsor and Toronto Western Schools.

3. The similarity of problems. These are much the same as ours; in some instances their approach is different, that is all. Sometimes it is simpler and more direct than our own.

4. Nursing over there seems altogether simpler and more serene. I don't quite know why this should be so. Perhaps they have kept a better sense of real values than we have. This I *do* know—the patient is more important than the nurse over there!

5. The bond of nursing is a very real and a very strong one. Language difficulties were unimportant. I thought of a phrase used on one occasion by Dr. Brock Chisholm, retired director of the World Health Organization. In speaking of the unsettled and troubled condition of the world Dr. Chisholm referred to the need for maintaining "islands of integration". He said WHO was such an "island". U.N.E.S.C.O. was another. It occurred to me that nursing is one such "island" too, and that on each one of us, provincially, nationally and internationally, rests a heavy responsibility for increasing the significance of that island—not only for nursing—but for the world.

The Incidence of Nitrates in Rural Ontario Well Waters

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FOR several years the Department of Bacteriology of the Ontario Agricultural College has been testing, on request, water samples submitted from rural home and school wells. This testing has been of a bacteriological nature only.

In 1950 attention was drawn to the incidence of methaemoglobinaemia which had been caused by the high nitrate level of well waters used in infant feeding. A subsequent search of the literature revealed that surveys of nitrate-bearing waters and reports of cases of methaemoglobinaemia were available from several states of the United States (2, 4, 5, 6, 8, 11, 12, 14, 15, 16, 17), three provinces of Canada (1, 9, 10, 13), and also from Belgium and England. The condition apparently is widespread in the United States and Canada.

This new interest in nitrate levels of water supplies began in 1945 after the observations of Comly (4). It was he who had first associated the high nitrate level of the water supply with the cyanosis observed in two infants 18 and 27 days of age. Since then many cases have been reported. The first fatal case in Canada was reported in Saskatchewan in 1948 (9). In this particular case the nitrate content of the well water was reported to be 1,320 p.p.m. Cases have also been observed in Manitoba, Alberta, and Dryden, Ontario.

Cases of methaemoglobinaemia in livestock, caused by the consumption of water containing high concentrations of nitrates, also have been reported (3, 18, 19).

Because of the possible relationship to both human and animal health in rural areas, and because of the apparent paucity of information concerning nitrate levels in Ontario well waters, it was decided to conduct this survey. In 1950, 1951, and 1952, this was conducted on a limited scale. In 1953 all water samples submitted for routine bacteriological examination were subjected to screening tests for nitrate and nitrite content. This same year a number of well waters were selected for periodic examination over a period of at least one year.

METHODS

At the beginning of the survey various chemical and bacteriological tests were conducted on each sample. After examining more than 100 samples in this manner, it was thought that the information gained relative to the incidence of nitrates was of little value, and these tests were abandoned.

The spot test for nitrates was the diphenylamine-sulphuric acid method. It was established that this test would detect as little as 0.5–1.0 p.p.m. of nitrate nitrogen. Those samples which gave a positive test were then subjected to the quantitative phenoldisulfonic acid test for nitrates (20). Readings were made by means of a spectrophotometer, and the amounts determined from a standard curve.

Because of the interference and possible false positive reactions, all water samples were spot-tested for nitrite content by means of Trommsdorf's reagent. This test was sensitive to 0.5–1.0 p.p.m. of nitrite nitrogen.

Samples from the wells selected for periodic examination to determine the fluctuation in nitrate nitrogen content were subjected to the quantitative phenoldisulfonic acid test and the spot test for nitrites. All samples were tested for bacteriological evidence of pollution in the usual manner.

Observations

I. *General Survey*

(a) *Dug wells.* Examination of Table I reveals that almost half of the samples from dug wells contained little or no nitrate; 18.8 per cent contained more than 10 p.p.m. of nitrate nitrogen. The highest level detected was 196 p.p.m.

TABLE I

Nitrate Nitrogen in 308 Dug Wells, 1950–1954

P.p.m.	No. of samples	Percent of total	Percent polluted
0–1.0	147	47.72	17.68
1–10	103	33.44	18.44
11–20	34	11.03	38.23
21–30	9	2.92	22.22
31–40	3	0.97	0.0
41–50	6	1.94	0.0
51–60	2	0.64	0.0
61–70	1	0.32	0.0
108	1	0.32	0.0
114	1	0.32	100
196	1	0.32	100

18.8 per cent of these well waters contained more than 10 p.p.m. nitrate nitrogen.

Seventeen per cent of the 0–1 p.p.m. nitrate-nitrogen group registered positive bacteriological evidence of pollution; 18.4 per cent of the 1–10 p.p.m. group; 38.2 per cent of the 11–20 p.p.m. group; and 22.2 per cent of the 21–30 p.p.m. group. Two of the samples containing more than 100 p.p.m. also were polluted. Twenty-nine per cent of those water samples containing more than 10 p.p.m. were polluted.

(b) *Drilled wells.* Examination of Table II reveals that 80 per cent of the samples from drilled wells contained little or no nitrate. Of this group 5.75 per cent were polluted. Five per cent of the drilled well samples contained over 10 p.p.m. nitrate nitrogen. Of this group none was polluted.

TABLE II

NITRATE NITROGEN IN 176 DRILLED WELLS, 1950–1954

P.p.m.	No. of samples	Percent of total	Percent polluted
0–1.0	139	78.97	5.75
1–10	28	15.99	7.14
11–20	7	3.97	0.0
21–30	1	0.56	0.0
31–40	1	0.56	0.0

5.1 per cent of these well waters contained more than 10 p.p.m. in nitrate nitrogen.

The following data may be of interest. A drilled well 107 feet deep yielded water containing 35 p.p.m. nitrate nitrogen; one of 114 feet depth contained 25 p.p.m.; one of 120 feet contained 6.5 p.p.m.; and one of 180 feet contained 17 p.p.m.

(c) *Dug and drilled wells.* Table III is a composite table of the results of all well water examined. Thirteen per cent of those samples contained more than 10 p.p.m. nitrate nitrogen. Thirty-seven per cent of those samples containing more than 10 p.p.m. nitrate nitrogen were polluted.

TABLE III

NITRATE NITROGEN IN 484 WELLS, DUG AND DRILLED TYPES 1950–1954

P.p.m.	No. of samples	Percent of total	Percent polluted
0–1.0	286	59.09	11.88
1–10	131	27.06	16.03
11–20	41	8.47	31.70
21–30	10	2.06	20.00
31–40	4	0.82	0.0
41–50	6	1.23	0.0
51–60	2	0.41	0.0
61–70	1	0.20	0.0
108	1	0.20	0.0
114	1	0.20	100
196	1	0.20	100

13.8 per cent of these well waters contained more than 10 p.p.m. nitrate nitrogen.

The author wishes to express his appreciation of the technical assistance of Mrs. M. Leitch.

II. Periodic Examination of Well Waters

Examination of Figure 1 reveals the fluctuation in nitrate-nitrogen levels during a period of one year. These waters were tested at the points indicated on the graphs. The results of the bacteriological tests for pollution are indicated by the positive and negative signs above the abscissa.

The term seasonal may not be justified in view of the fact that these waters have been tested for a period of one year only. The figures might not be so irregular had it been possible to test at more frequent intervals. Among the well waters thus examined, the results from nine are presented, and are thought to give a fair representation of the fluctuations that apparently occur. The wells chosen are as follows:

No. 1—Drilled well, 28 feet deep, Guelph vicinity.
No. 2—Shallow dug well, south of London.
No. 3—Dug well, 6 feet deep, near St. Jacobs.
No. 4—Dug well, 45 feet deep, near Agincourt.
No. 5—Dug well, 15 feet deep, near Preston.
No. 6—Dug well, 15 feet deep, near Hawkesbury.
No. 7—Dug well, 75 feet deep, near Newmarket.
No. 8—Dug well, 25 feet deep, near Newmarket.
No. 9—Drilled well, 150 feet deep, near Elmira.

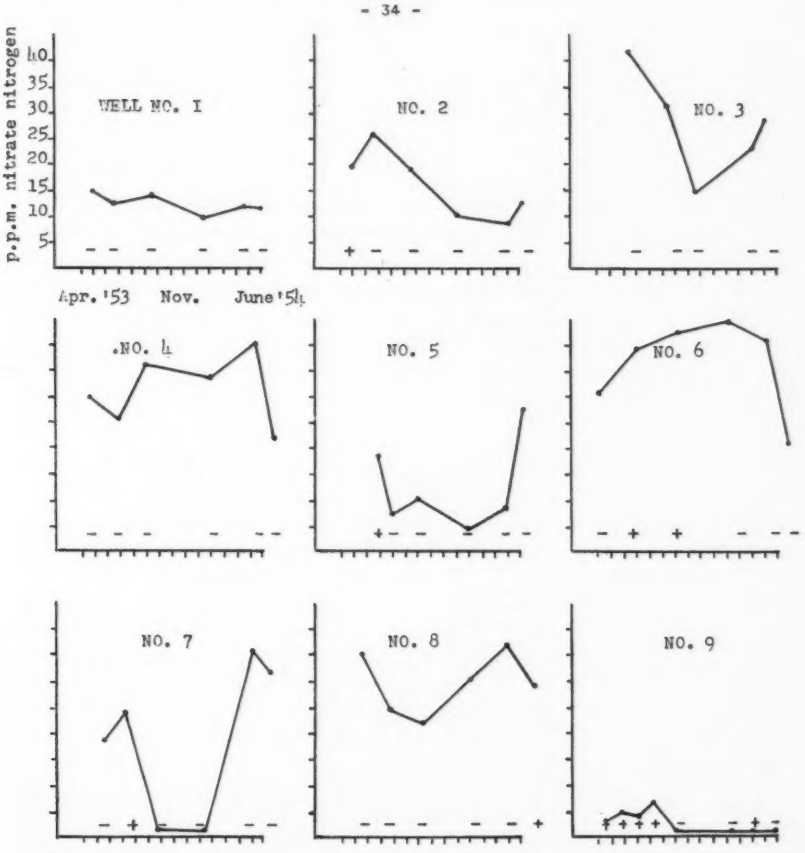

FIG. 1. Seasonal fluctuation of nitrate-nitrogen content in mine wells during a period of one year.

DISCUSSION

It would appear from the observations made that the incidence of nitrates is greater in dug than in drilled wells. A drilled well is not, however, an indication of nitrate-free water.

Although a greater percentage of well waters which contain nitrate nitrogen are polluted, there still is a high percentage of nitrate-containing waters which show no evidence of pollution. This is in agreement with previous work done elsewhere (8, 11, 13, 14, 16). For this reason other sources of nitrates have been suggested (8, 11, 13, 14, 16). These sources might include seasonal leaching of the topsoil, vegetation, fertilizers, tree roots and nitrate deposits.

It has been pointed out that the fluctuation in the nitrate-nitrogen levels cannot be interpreted as seasonal unless a similar picture was obtained over a period of at least another year. In a similar survey conducted in Kansas (11) it was found that seasonal fluctuation did occur in four municipal wells over a two-year period. Here it was found that a peak was reached in the winter season, and this peak fell off sharply during late spring and summer. In a similar survey of water from wells in Alberta the marked flucutation of nitrate-nitrogen content has been demonstrated.

Summary

The nitrate-nitrogen levels and the incidence of pollution of 484 Ontario well waters have been determined. It is evident that nitrate-nitrogen levels above the 10 p.p.m. which has been suggested as the maximum for safety occur in such water supplies. This condition is most common in dug wells, but drilled wells are not free of this pollution. It would appear that these nitrate levels are not the result of pollution from human and animal sources only. The nitrate-nitrogen level may fluctuate markedly and a single test for nitrate content is of doubtful value.

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Haemagglutination Titres Following BCG Vaccination of Human Subjects

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THE Middlebrook-Dubos haemagglutination test (5) for antibodies to certain fractions of the tubercle bacilli has been directed, for the most part, to the diagnosis of tuberculosis or to the determination of activity of the disease. In addition, there have been a few reports on changes in the serum levels of humans following vaccination with BCG. Haley, Davey, Adcock and Owen (3) observed that a significant shift toward higher titres occurred three months following vaccination, but concluded that the antibody response was of a very low order. Fleming, Runyon and Cummings (1) reported that the changes of the levels of haemagglutination titres were inconsistent. The present study was undertaken to evaluate further the significance of the test following BCG vaccination.

Materials and Methods

The sera from 51 students were tested for haemagglutination antibodies by the method of Middlebrook and Dubos (5) except that the antigen used to sensitize the sheep cells was a concentrated preparation of Old Tuberculin* and phosphate buffer pH 7.0 was used as diluent. These served as control samples.

Following tuberculin testing the 33 tuberculin-negative students were vaccinated with BCG by the Central Tuberculosis Clinic, Winnipeg, by the scarification method. Their sera were again examined by the haemagglutination test at three weeks, six weeks and six months.

As a further control the sera from 17 tuberculin-positive students were tested by the haemagglutination reaction six months after tuberculin testing. One of the 18 tuberculin positive students was not available.

The positive standard rabbit serum prepared by the intravenous injection of heat-killed bovine tubercle bacilli (Ravenel) as described by Rothbard and associates (9) consistently gave a titre of 1: 1024.

Results

The distribution of haemagglutination titres before and after vaccination is presented in Table I. The titres of the control sera on the 51 students ranged

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*Old Tuberculin 4X International strength was kindly furnished by Dr. H. D. Piersma, Pearl River, New York.

TABLE I

DISTRIBUTION OF HAEMAGGLUTINATION IN NON-VACCINATED AND VACCINATED SUBJECTS

Sera	Titres							Total
	0	1.4	1.8	1.16	1.32	1.64	1.28	
Un-vaccinated								
Student Control	1	1	8	6	2			18
After six months	1	2	5	2	7			17
Vaccinated								
Student Control	9	6	8	7	3			33
Three weeks after BCG		2	9	6	9	4	3	33
Six weeks after BCG				4	16	8	4	32
Six months after BCG	5	4	5	8	9	2		33

from 0–1 :32. This range applied to the group that proved to be tuberculin-positive as well as to the group that was tuberculin-negative; and the difference in titres between the two groups was found to be not significant statistically. Similarly, the titres of the sera from 17 non vaccinated students examined six months after tuberculin testing ranged from 0–1: 32.

The titres of the sera of the 33 vaccinated students ranged from 1: 4–1: 128 at three weeks, 1: 16–1: 128 at six weeks and 0–1: 64 at six months. A titre of 1: 16 or higher was present in the sera of 100% of the students after six weeks, whereas only 27% of the sera showed this level before vaccination. Although there was a decrease in percentages when the titres were classified according to the level of 1: 32 and higher, the relative differences remained the same. The percentage distribution of haemagglutination titres of the vaccinated students is presented graphically in Figure 1. The titres in the control

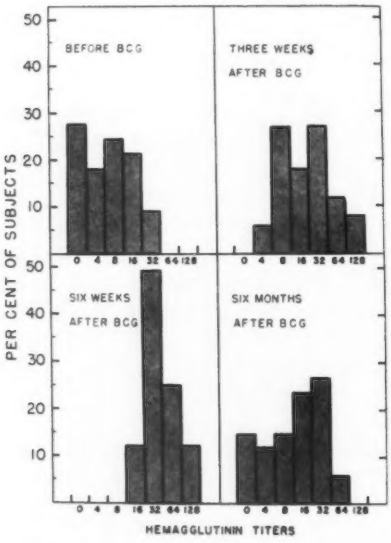

FIG. 1. Percentage distribution of haemagglutination titres before and after BCG vaccination.

or pre-BCG determination were significantly different from those obtained at three weeks and at six weeks but were not significantly different from those obtained at six months following vaccination.

The shift in individual titres is shown in Table II. In the non-vaccinated group no students showed a two-tube rise in titre after the six-months' interval. In the vaccinated group 22 students or 61% showed a two-tube rise or higher in titre at three weeks 28 or 85% at six weeks and 11 or 33% at six months.

TABLE II

CHANGES IN INDIVIDUAL HAEMAGGLUTINATION TITRE

Sera	No.	Titre Decreased	Titre Unchanged	Times increase of Titre					
				1	2	3	4	5	6
Non-vaccinated									
After 6 months	17	0	10	7					
Vaccinated									
After 3 weeks	33	1	2	8	17	4	1	0	0
After 6 weeks	32	0	0	5	11	9	6	1	1
After 6 months	33	5	7	10	8	2	1	0	0

DISCUSSION

The results of the haemagglutination reaction showed no correlation of the prevaccination titres to skin sensitivity and are in agreement with recent observations (1, 3). This lends support to the statement of Rich (8) that there is no established relationship between tuberculin sensitivity and the presence of circulating antibodies.

In the present series a much higher degree of antibody response was exhibited than has been reported by other workers. (1, 3). Haley *et al.*, who tested 166 subjects three months and seven months after vaccination, failed to examine the sera at six weeks when the height of the antibody level occurs as shown by Hawirko (4). Fleming *et al.* tested eleven nurses and it is difficult to explain the low response reported. Both groups of workers used human rather than sheep erythrocytes for sensitization and there is some evidence (2) that this requires adjustment of the concentration of the antigen.

The data reported herein show that humans vaccinated with BCG generate antibodies which can be quantitatively measured by the haemagglutination test. The shift to higher titres which occurred at three and six weeks offers convincing evidence that a specific antibody was present. It is not assumed that the antibody measures the immune state of the individual although it may probably play some role in the resistance mechanism. The present acceptance of the development of a positive tuberculin test as a criterion that vaccination has "taken" has been questioned many times. These results encourage the suggestion that the haemagglutination reaction may offer a more satisfactory method for determining the response of the host to BCG. The shift of 85% of the titres to a two-tube rise or higher at six weeks probably indicates that a rising titre, as in the agglutination test for typhoid, may be of more value in the interpretation of results than a single titre.

The decline of circulating antibodies to normal values suggests that a reassessment of the protective effect of BCG after a period of six months should be considered. Myers (6) states that there is no evidence that BCG administered to children or young adults has any influence on clinical tuberculosis which develops two or three years after the initial vaccination. It would be of value to carry out animal-survival tests after an interval of six months or longer following vaccination instead of the conventional interval of three weeks to three months. It is possible that protection may remain since the antibody-forming cells, once stimulated, react more quickly and effectively to a challenging infection even when the antibody level declines.

It is apparent that the selection of a titre of 1: 16 or higher as a measure of a significant response is supported by the findings reported. This level was suggested earlier by Fleming (1) and Hall (2).

Summary

1. The sera of 33 tuberculin-negative students who were vaccinated with BCG were examined for haemagglutinins to tuberculin-sensitized sheep cells and showed a significant increase at three weeks and at six weeks but returned to normal values at six months.

2. The sera of 33 tuberculin-negative and 18 tuberculin-positive subjects showed no correlation between haemagglutinin levels and tuberculin sensitivity.

3. Data are presented that suggest that a rising titre may be of more value in the interpretation of results than a single titre.

4. These results lend support to the suggestion that the haemagglutination reaction may offer a more satisfactory method than tuberculin testing for determining the response of the host to BCG.

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We wish to express our appreciation to Dr. E. L. Ross and Mr. Henry Daneleyko for their co-operation and for furnishing us with blood samples from the subjects undergoing vaccination. Mr. Ivan Kochan gave valuable technical assistance.

Canadian Journal of Public Health

MR. R. L. RANDALL RECEIVES NEW APPOINTMENT

MR. R. L. Randall, Assistant Editor of the Journal, has been appointed as Assistant Editor of the Canadian Medical Association Journal and assumed his new duties in December. It is pleasing that the excellent work of Mr. Randall in the publication of the Canadian Journal of Public Health has been so well recognized and that he is afforded a larger opportunity for his talents in editorial work.

Few of our members know of the work that is entailed in the publication of a journal and may not realize how much the Association is indebted to Mr. Randall for his many years of devoted service. He was Assistant Editor and was in this capacity responsible for all the details of publication. Further, he assumed much of the responsibility for the organization of the annual meetings, particularly of programs, and for the conduct of the examinations for sanitary inspectors. His work was well known to health departments across Canada. Such a large responsibility was gladly assumed by Mr. Randall because he was deeply interested in the work of the Association.

The Association has appointed Mrs. Joyce Howes as Editorial Assistant. Mrs. Howes has had editorial experience and during the past months has had the opportunity to become familiar with the Journal. She will, also, assist the Honorary Secretary in the various activities of the Association, including the Annual Meeting and the work of the various standing committees.

The Association extends its best wishes to Mr. Randall in his new appointment and again expresses appreciation of his splendid services.

POST-GRADUATE TRAINING IN PUBLIC HEALTH

PROVISION for post-graduate training in public health was part of the planning of Dr. John Simon, who was the master-builder of public health administration in England. As early as 1888, physicians serving as county medical health officers were required to have a Diploma in Public Health. Requirements for this diploma were early established by the General Medical Council and this authority has continued to be responsible for it. The Public Health Act of 1875, which was the crowning work of Dr. Simon, provided for the dividing of England and Wales into health districts and required that a physician be appointed to serve as medical officer of health for each district or muncipality. In Canada, the Public Health Acts of the various provinces, with the exception of Quebec, are based in large part on this Act and require that the office of health officer be filled by a physician.

For some years previously, the calendar of the Faculty of Medicine, Univer-

sity of Toronto, contained a curriculum for the Diploma in Public Health, but it was not until 1912 that the course was first given. Since that time, with the exception of one year during World War I, candidates have been registered for the course. Five hundred and thirty four physicians have received the Diploma in Public Health from this University and of this number 316 have been granted since 1940. In 1945, the University of Montreal introduced a course leading to the Diploma in Public Health and since then a number of physicians have received the Diploma from that University. Thus the developments in these universities resulted in the establishing of two Schools of Hygiene in Canada. Both are accredited by the American Public Health Association for post-graduate instruction. In all there are thirteen accredited schools of hygiene on this continent. The organization of schools of hygiene has permitted the training of specialists in various branches of public health as well as provision of training for dentists, veterinarians, engineers, and graduates in Arts and Sciences desiring appointments in bacteriology, vital statistics, public health education and other fields.

In the School of Hygiene, University of Toronto, a course for physicians leading to the Diploma in Industrial Hygiene was introduced twelve years ago. The number of candidates has not been large, but those who have completed the work are occupying important positions in industrial health programs. The provision of this course is due largely to the vision of Dr. J. G. Cunningham whose work in industrial hygiene in Canada is well known. Dr. D. Y. Solandt, Head of the Department of Physiological Hygiene, School of Hygiene, has given direction to the course and has been deeply interested in its development.

Certification as a specialist in public health has been provided by the Royal College of Physicians and Surgeons of Canada. The requirements are similar to those pertaining to certification in medicine, surgery and other branches of medicine. Graduates in medicine proceeding to certification in any one of the special fields are required to spend at least five years in training following graduation. Over one hundred physicians have received certification in public health. Of special interest has been the recent approval by the Royal College of a request that physicians proceeding to certification in medicine might spend one year in public health training including the D.P.H. course and the field work associated with it. Also, approval has been given by the College to a year of work in Industrial Hygiene, including the course leading to the Diploma in Industrial Hygiene and the field experience required for this qualification. Physicians who include either public health or industrial hygiene in their training for certification in medicine will find the experience to be most valuable. This action by the Royal College of Physicians and Surgeons is greatly appreciated by those who are deeply concerned with the need for outstanding leadership in public health in Canada. It is important that the office of health officer be filled by a physician with special training in public health. Today public health is concerned with problems of chronic illness, mental illness, rehabilitation, accident prevention and the provision of medical, dental, nursing and hospital care for every citizen of Canada. The training of the medical officer of health must be comprehensive, and the development of schools of hygiene is evidence that excellent provision is being made to provide the desired instruction.

ABSTRACTS OF PAPERS PRESENTED AT THE TWENTY-SECOND ANNUAL CHRISTMAS MEETING OF THE LABORATORY SECTION: CANADIAN PUBLIC HEALTH ASSOCIATION, MONTREAL, DECEMBER 13 and 14, 1954

Recherches sur le mécanisme de la vitesse de sédimentation des globules rouges.

J. STERNBERG et A. MERCIER, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal.*

TWO PLASMA constituents have usually been correlated to the increase of the ESR: (1) fibrinogen and (2) a not yet identified glycoprotein migrating with the alpha 2 fraction; the latter is probably related to the catabolism of nucleic acids and has enzymic properties (haptoglobin). However, the respective role in the mechanism of ESR of each mentioned compound has not been established.

The isolation of a cryoglobulin (paraprotein) from a multiple myeloma serum permitted us to carry on experiments with the above substance *in vitro*. The high polysaccharidic content of the paraprotein suggests a relationship with the alpha 2 globulin, despite its migration with the gamma fraction. The staining affinity of the glucidic copula is similar to that of long-chained polysaccharides (dextran), rather than to that of nucleic acid residues.

When the above paraprotein was added to normal oxalated blood, the ESR increased proportionally to the added amount until it reached values as high as those of multiple myeloma.

Comparison between the ESR accelerating action of the paraprotein and that of various polysaccharides showed a similar property in dextran and little or no increase in heparin, hyaluronic acid, glycogen or DNA.

Increasing amounts of fibrinogen added to a system oxalated serum—RBC also accelerated the ESR proportionally to the added fibrinogen, but the aspect of the sedimentation curve was different from that observed with glycoproteins. It is suggested that fibrinogen acts upon the first step (5–15 minutes), accelerating the pile formation of erythrocytes, while the glycoproteins act mainly upon the second step (15–45 minutes), accelerating the falling rate of the already piled erythrocytes.

This hypothesis is supported by the fact that addition of myeloma paraprotein to a system serum—RBC does not influence the first step in the absence of fibrinogen, but once the RBC is piled together, the fall is very rapid, reaching almost the same values as in multiple myeloma.

The two-step fibrinogen-glycoprotein mechanism could explain certain discrepancies observed between an apparent clinical improvement and a continuous high ESR; it shows furthermore the advantage of using a constellation of laboratory tests centered upon the ESR (determination of fibrinogen, haptoglobinemia, electrophoresis) in order to get a better prognostic value.

Studies of Cervical and Vaginal Bacterial Flora in Relation to Human Infertility.*

C. L. BUXTON, W. H. HERMANN and ANNA L. SOUTHAM, *Department of Obstetrics and Gynaecology, Columbia University, College of Physicians and Surgeons, and the Sloane Hospital for Women, New York City; and* GRACE T. GIRVIN, *Department of Bacteriology and Immunology, McGill University, Montreal.*

DATA ARE presented which were collected over a five-year period of investigation concerning the possible relationship of the bacterial flora of the cervix and vagina to infertility. Particular attention is given to the isolation of organisms which have the ability to agglutinate human spermatozoa 'in vitro'. Microscopic and macroscopic agglutination tests have been

developed for the quantitative assay of sperm agglutination by such microorganisms. The results of chemotherapy with respect to the effect on the genital flora and the pregnancy rate are discussed.

*Supported by U.S. Public Health Research Grants from April 1952 to March 1954.

Méthode simplifiée pour déterminer la sensibilité des Bactéries anaerobies aux Antibiotes.

B. MARTINEAU and V. FREDETTE, *Département de Bactériologie de la Faculté de Médecine et Institut de Microbiologie et d'Hygiène de l'Université de Montréal.*

A SIMPLIFICATION of the Fredette-Takahashi method consists in diluting the pure culture directly in the Veillon agar tubes, then placing the bottom third of the contaminated tubes in ice-water until firm, finally dropping Difco antibiotic discs on to the solid portion of the agar column.

Thus suspended, the discs give clear-cut zones of inhibition in less than 24 hours when the bacteria are sensitive. As previously reported, Gram-positive anaerobes do not respond to antibiotics in the same manner as the aerobes, thus calling attention to the necessity of performing actual tests on all anaerobic bacteria isolated from pathological cases.

The simplified technique now described may be of considerable interest, for medical bacteriologists particularly.

Staphylococci—Resistance to Antibiotics and Phage Types.

E. T. BYNOE, R. H. ELDER, and R. COMTOIS, *Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.*

FIVE HUNDRED and thirty strains of *M. pyogenes* have been phage typed and tested by tube and disc methods for resistance to antibiotics. The organisms were isolated in a large general hospital from dressings applied after "clean" surgery, from abscesses, from noses and throats of healthy personnel and from air samples.

Of 530 strains phage typed, 8.8 per cent fell into Group I, 10.9 per cent into Group II, 70.7 per cent into Group III and 0.2 per cent into Group IV, while 4.7 per cent could not be placed into any of the above groups and were classified as Miscellaneous and 4.5 per cent were untypeable.

When tested for resistance to Penicillin, Chlortetracycline, Oxytetracycline, Chloramphenicol, Erythromycin, Streptomycin, Neomycin and Bacitracin, it was found that, in general, Group I strains were moderately resistant to Penicillin, Chlortetracycline and Oxytetracycline but sensitive to others. Group II strains were sensitive to all antibiotics. Group III strains were resistant to all but Chloramphenicol, Erythromycin and Neomycin, while the Miscellaneous strains were sensitive to all but Penicillin and the untypeable strains to all but Bacitracin.

The significance of these findings is discussed.

The "M.C. Number" of Serum in Infectious Hepatitis.

L. E. ELKERTON, A. M. MILLAR, and J. J. HAMVAS, *Division of Laboratories, Ontario Department of Health, Toronto.*

THIS PAPER deals with the use of a buffered reagent mixture of mercuric chloride to produce a percentage range of slide flocculation with abnormal serum globulins. Persistence of a high "M.C. Number" of serum is stressed as a measure of convalescence in infective hepatitis.

Méthode simple de purification des antitoxines et résultats cliniques.

J. DEREPENTIGNY, A. GUERAULT, et J. H. CHARBONNEAU, *Institut de Microbiologie et d'Hygiène de l'Université de Montréal et Hôpital Pasteur, Montréal.*

A SIMPLE method to purify diphtheria and tetanus antitoxins has already been described by one of the authors. The procedure includes digestion by pepsin, denaturation by heat, frac-

tionated precipitation by sodium sulphate and subsequent elimination of the salt by crystallization at +4°C.

Modifications of this new method have now been introduced: by controlling more precisely the pH and the temperature, it is possible to obtain a sharper precipitation of the digested antitoxin and to avoid concurrent losses.

This technique has been used for the last four years, and over 200 lots of crude antitoxin have been processed.

The most striking result is the absence of pyrogens in all these purified sera.

The purification factor (6) and the concentration factor (3.2) remain easily reproducible. The yields (40–60) are now stabilized by the above-mentioned improvements.

In a clinical survey, these purified antitoxins were injected into one hundred and thirty-four patients. The results were as follows: (1) no immediate allergic reaction; (2) eight cases of late allergic reactions, only two being of a relatively severe type; (3) marked improvement over the undigested antitoxin prepared by the previous salting-out method.

Meningococcal Infections seen at a Children's Hospital during the years 1940 to 1954.

FRANCES H. PRISSICK, *Children's Memorial Hospital and McGill University, Montreal.*

THIS PAPER reports on the incidence and type of meningococcal infections seen at a children's hospital during the years 1940–1954. Note is made of an unusual number of severe infections caused by *N. meningitidis* in the fall of 1952 and continuing into 1953. Antisera for the grouping of many of these 1953 strains were provided through the kindness of Dr. Sophie Cohen, United States Public Health Service.

A Quantitative Study of the Optimal Conditions for Production of Streptolysin-O*.

ANNE L. GILLEN and HARRY A. FELDMAN, *State University of New York, College of Medicine, Syracuse, New York.*

THE RATES and quantities of streptolysin-O formation were determined in three broth media following their inoculation with the Richards strain. The broths used were Todd-Hewitt (Difco) and two originated in this laboratory (Harmon and NMP). Streptolysin-O was measured in terms of SL_{H50}'s per ml; an SL_{H50} is that amount of streptolysin-O which lyses 50% of a 1.2% suspension of sheep erythrocytes. This can be determined precisely by a method devised in this laboratory and will be reported elsewhere. The curves for production of streptolysin-O were plotted in relation to the curves obtained by simultaneously measuring the changes in pH and optical densities of the media during the various growth phases of the streptococci.

All broths showed a plateau-like curve for streptolysin-O production but this curve could be increased in the Harmon medium by adjusting the pH during growth although this was not true of the other two media. By supplying additional sugar during growth, the streptolysin-O content could be raised in the Todd-Hewitt broth only. This seems to indicate that growth in the Todd-Hewitt broth was limited by its sugar content, growth in the Harmon medium by its terminal pH and in the NMP, by neither. Contrary to previous reports no sudden, irreversible loss of streptolysin-O content was noted at 37°C., for exposure to this temperature for 13 hours resulted in negligible changes. It appears, therefore, that the plateau level represents the total streptolysin-O produced in a given medium rather than being a region where streptolysin-O production and destruction proceed at similar rates.

*Supported by a grant from the Masonic Foundation for Medical Research and Human Welfare.

Vaccination contre la grippe. La technique de vaccination de rappel par aerosol.

V. PAVILANIS et F. SOMLO, *Institut de Microbiologie et d'Hygiène et École d'Hygiène de l'Université de Montréal.*

FASEKAS DE St. Groth has noted a striking increase (up to 100-fold) in the degree of protection

of mice against experimental disease if the intraperitoneal injection of influenza vaccine is followed by an intranasal inoculation of the same vaccine.

Aerosol particles should penetrate into the respiratory tract more efficiently than the liquid given in nasal instillations, and the retention and penetration of aerosol particles, in the human respiratory tract, depend on particle radius. Optimum penetration is obtained with particles of 0.8 to 1.0 μ in diameter.

Influenza is a local disease and the lesions are localized in the respiratory epithelium.

For these reasons, in the present work, and in order to enhance the local immunity against influenza, the authors have completed the regular schedule of human vaccination by adding a booster dose by aerosol; a "Vaponefrin Aerosol Apparatus" has been used, which gives particles of 1 to 2 μ in diameter.

Le taux des anticorps après la vaccination anti-grippale.

V. PAVALANIS, F. SOMLO, et A. BOUDREAULT, *Institut de Microbiologie et d'Hygiène et Ecole d'Hygiène de Montréal.*

TWO MONTHS after vaccinating human volunteers with influenza polyvalent vaccine (PR8, Lee, FM1 and Cuppett), serum samples were taken and tested for haemagglutination inhibition. The groups were as follows: (1) vaccinated with one injection of influenza vaccine; (2) vaccinated with one injection of influenza vaccine, followed four weeks later by a booster dose given by aerosol; (3) controls, injected with allantoic fluid without virus; and (4) normal population, not vaccinated. Each group was represented by 100 serum samples.

Results: Antibody level in groups 3 and 4 was identical as tested against PR8, Lee, FM1 and Cuppett strains. There was no marked difference between antibody level in groups 1 and 2. On the other hand, groups 1 and 2 (vaccinated) showed a higher antibody level than that observed in the controls (groups 3 and 4). The difference of antibody level was most marked for Influenza B and PR8, less for Influenza FM1 and Cuppett.

Cultivation of *H. pertussis* (Phase 1) in Chemically Defined Medium.

R. J. WILSON, *Connaught Medical Research Laboratories, University of Toronto.*

H. pertussis in phase 1 may be cultivated in a chemically defined medium containing amino acids, salts, charcoal and growth factors of known chemical composition. While certain ingredients of the medium are essential, little is known, as yet, about the remainder. Some constituents have been shown to exert a marked stimulation of growth, and evidence to date suggests that their presence permits of serial transfer.

Meningitis due to *Leptospira canicola*: First Report of Occurrence in Canada.

M. SAINT-MARTIN, *Hôtel-Dieu Hospital, Montreal, and* J. I. H. CHARBONNEAU, *Pasteur Hospital, Montreal.*

THE PATIENT, bitten by a dog three weeks previous to his admission to hospital, presented these main symptoms: nausea, frontal headache, stiffness of the neck, chills, moderate fever, euphoria, dizziness and movement incoordination. Dark-field examinations of cerebro-spinal fluid and urine showed leptospiral-like organisms. Guinea-pig inoculation revealed the presence of leptospirae in the animal's heart, blood and liver. Blood specimens gave positive agglutination-lysis tests for *Lept. canicola* in dilutions of 1: 16,000 and 1: 100,000. Although penicillin treatment appeared to produce a clinical cure, a relapse occurred two days after the patient was discharged. A combined penicillin-streptomycin treatment produced a definitive cure after 30 days' hospitalization. Therapeutic and epidemiological aspects of canicola fever are discussed.

The Membrane Filter in the Bacteriological Analysis of Sea Water.

A. D. TENNANT and I. E. ERDMAN, *Laboratory of Hygiene, Department of National Health and Welfare, Ottawa.*

THE LABORATORY of Hygiene has carried out a regular summer program in the analysis of inter-tidal sea water samples for evidence of pollution as a part of the control of the shellfish industry in the Maritime provinces. Normally the procedure used is the lactose broth to brilliant green bile "confirmed" test for the presence of coliforms. During the past three years, parallel studies have been carried out on a portion of the samples examined using the membrane filter apparatus and techniques. Four media developed for use with the membrane filter for the detection of coliforms have been tried. Varying degrees of difficulty were encountered with each. To date the powdered Endo Medium prepared by the Environmental Health Centre in Cincinnati has proved to be the most readily usable. Further difficulties were encountered with the presence of silt and other suspended matter, always present in some degree in water samples taken from inter-tidal areas. Difficulties arising from a mobile-laboratory operation in this type of study are also discussed.

The Effect on Rabbits of Repeated Exposure to Type 12 Streptococci.

R. W. REED and B. H. MATHESON, *Department of Bacteriology, Dalhousie University, Halifax.*

IT HAS been shown that rabbits infected with type 12 streptococci or injected with type 12 filtrate will develop the clinical signs of acute nephritis from 9 to 21 days later. They appear to recover, then again show the same clinical signs 8 weeks after primary exposure. This occurs whether or not the animals are re-exposed to type 12 streptococci or their products, but urine changes are much more severe in re-exposed animals. Kidney changes in all animals showed primarily tubular damage with minimal changes in the glomeruli. The nature of type 12 nephritogenic substance is discussed in relation to these findings.

Purification du sérum antidipthérique par diazotation.

A. BOUDREAULT, A. BORDUAS, et J. DEREPENTIGNY, *Institut de Microbiologie et d'Hygiène et Ecole d'Hygiène de l'Université de Montréal.*

A POSSIBLE general method for the specific purification of antiprotein antibodies has been described by Sternberger and Pressman. This method has been adapted to the purification of diphtheria antitoxin.

The purification is based on the specific precipitation of antitoxin by a modified toxin which can be easily dissociated and removed from the flocculate.

This modified toxin is prepared by coupling the toxin with diazotized p-aminobenzenearsonic acid. The modified toxin can be removed from solution with a suspension of calcium aluminate at pH 12, leaving diphtheria antitoxin in solution.

The antitoxin purified by this technique does not flocculate but still protects the guinea-pig against the toxin. The yields are about 10%.

Amino-acid determinations, electrophoresis and hemagglutination tests were performed on the purified antitoxin.

Effet de divers antibiotiques sur les infections que provoque la cortisone chez le rat.

P. LEMONDE, *Institut de Médecine et de Chirurgie Expérimentales et Institut de Microbiologie et d'Hygiène de l'Université de Montréal.*

CORTISONE TREATMENT induces the appearance of infections, to which the animals are normally resistant. Penicillin protects poorly against such infections. Sulfamethazine is somewhat more effective. Combinations of penicillin and Streptomycin or of penicillin and aureomycin afford almost complete protection.

The effect of ACTH on BCG Infection in the Guinea-Pig.

HELEN C. PLUMMER and M. H. BROWN, *Connaught Medical Research Laboratories, University of Toronto.*

GROUPS OF guinea-pigs were infected by the intraperitoneal injection of 10 mg. of fresh BCG culture. Treatment with ACTH was started either on the day of infection with BCG or four weeks later. The treatment consisted of subcutaneous injection of 1 unit of ACTH daily for five days each week for a period of one, two, three, five, or six months. Animals were chloroformed for autopsy immediately after the last treatment or at periods varying from one month up to a year later. Control groups of similar numbers of guinea-pigs consisted of (1) BCG-infected, (2) ACTH-treated and (3) normals. Animals were tested with 1 mg. Old Tuberculin every two weeks for the first five months on test, and thereafter once a month. Autopsies were carried out on all animals dying while on test, as well as on those chloroformed at chosen intervals. Treatment with ACTH did not produce any significant reduction in the average size of the tuberculin reactions in the BCG-infected animals, nor did it cause a greater spread of BCG infection.

Nouvelles données sur la valeur protique de la Cuty-BGG pour la recherche de l'allergie tuberculeuse en vue de la vaccination par le BCG.

A. FRAPPIER et R. DESJARDINS, *Institut de Microbiologie et d'Hygiène et Ecole d'Hygiène de l'Université de Montréal.*

THE AUTHORS have made further observations on the detection of tuberculous allergy by means of the Cuti-BCG (BCG scarification test), which is a skin bacillary test described by Frappier and Guy in 1948 and currently used in Canada for allergy screening prior to vaccination.

They have studied the relationship between bacillary and tuberculin allergy, the respective value of live or heated BCG in the use of the test, the optimum bacillary concentration, the evolution of the reactions, the degrees and duration of the allergy produced by the BCG test and the period of preservation of the activity of the heated bacillary suspensions.

E. coli Strains Associated with Gastroenteritis in Infants with Special Reference to a Hospital Outbreak due to type 111:B4.

VERA CROSSLEY, MAREE SIMPSON, and MARGARET FINLAYSON, *Division of Laboratories, Ontario Department of Health.*

OBSERVATIONS IN a review of the bacteriological investigation of 138 cases.

Une Epidémie de microsporie due à *Microsporum canis*.

B. PRIMEAU, G. CHAREST, E. LALANDE, et F. BLANK, *Division de l'Hygiène de l'Enfance, Service de Santé de la Ville de Montréal, et Département de Bactériologie et Immunologie, Université McGill, Montréal.*

UNE ÉPIDÉMIE de microsporie d'une certaine étendue fut signalée pour la première fois dans un quartier de Montréal en septembre 1954. *Microsporum canis* fut identifié comme étant l'agent causal de cette épidémie. Chiens, chats et êtres humains ont servi d'agents vecteurs dans la diffusion de l'infection, en particulier chez les enfants.

Mycotic Infections of the Ear Canal.

F. BLANK and C. A. STUART, *Department of Bacteriology and Immunology, McGill University, and Department of Otolaryngology, Royal Victoria Hospital, Montreal.*

FIFTY-FIVE cases of mycotic infections of the ear canal were observed during a thirty months' period. They were caused by *Trichophyton rubrum, Epidermophyton floccosum, Monosporium apiospermum, Candida albicans, Candida parapsilosis,* and five different species of the genus *Aspergillus.* Mycotic infections of the ear canal seem to be more frequent than is commonly suspected. Some of the problems of diagnosis and pathogenicity involved are discussed.

Preparation of an Antigen from *Histoplasma capsulatum* for Complement-Fixation Test.

N. A. LABZOFFSKY and J. B. FISCHER, *Division of Laboratories, Ontario Department of Health.*

FROM THE yeast phase of an organism isolated from an Ontario case of 1954.

Electron Microscopy of the Crystalline Inclusions of *Bacillus thuringiensis*.

C. L. HANNAY, *Division of Bacteriology, Science Service, Dominion Department of Agriculture, Ottawa.*

The Efficacy of Tetanus Toxoid.

G. W. O. MOSS, G. G. WATERS, and M. H. BROWN, *Connaught Medical Research Laboratories, University of Toronto.*

TETANUS ANTITOXIN titrations were carried out on 100 Canadian ex-servicemen who had not had booster doses of tetanus toxoid since some time before their discharge from the services eight or more years previously. Ninety-seven showed a titre of greater than one one-hundredth of a unit and sixty-one a titre of greater than one-tenth of a unit.

The antitoxin response to a 1 ml. dose of fluid tetanus toxoid was measured on the seventh day in 94 instances and on the sixth to tenth day in the remaining 6. All 100 responded to a level of greater than one-tenth of a unit of antitoxin. Seventy-one had a level of greater than ten units.

Appréciation de la vitalité de cultures de BCG d'âges différents par l'épreuve intradermique chez le cobaye.

A. FRAPPIER et P. MAROIS, *Institut de Microbiologie et d'Hygiène et Ecole d'Hygiène de l'Université de Montréal.*

THE EXTENSIVE use of Jensen's modified intradermal test in the guinea-pig has shown its sustained sensivity and reliability. Formerly used for the comparison of weekly batches of BCG vaccine, this test has been applied to the study of BCG cultures grown under various conditions.

In the present work, the authors compare the irritative power of BCG suspensions obtained from 7-day and 14-day cultures in Sauton's medium. The younger suspensions produced, in the guinea-pig, reactions which appeared sooner and which presented much larger areas of irritation than those initiated by the 14-day cultures. These differences, observed between suspensions showing no appreciable variation in the amount of viable units, as well as that of the bacillary mass, point to different degrees of vitality for suspensions of various ages.

The Synthesis of Nucleic Acid by *E. coli*.

L. SIMINOVITCH, S. M. LESLEY, and A. F. GRAHAM, *Connaught Medical Research Laboratories, University of Toronto.*

THE RATE of incorporation of $P^{32}O_4$ into the nucleic acids of *E. coli* during growth has been measured. It has been found that P^{32} labelled cells retain their radioactivity completely during growth. In each new generation the synthesis of DNA is equal to the amount originally present. This has been confirmed for RNA as well as DNA by measurements of P^{32} uptake into individual nucleotides.

Nouvelles possibilités offertes par l'embryon de poulet de 19 jours dans l'étude *in vivo* de la sensibilité des staphylocoques aux substances antibactériennes.

A. FRAPPIER et S. SONEA, *Département de Bactériologie de la Faculté de Médecine et Institut de Microbiologie et d'Hygiène de l'Université de Montréal.*

THE STAPHYLOCOCCAL infection of the 18- or 19-day old chick-embryo was adapted as an *in vivo* test for antibacterial substances. The test consists in introducing the antibacterial substance into the air-sac of the egg, and a desired number of staphylocci into the embryo itself.

This method presents the following characteristics: (1) A *progressive* staphylococcal infection, obtained with a small number of bacteria, which by multiplying *in vivo* give a lethal septicemia. (2) The severity of the infection is proportional to the number of the injected bacteria. Thus, the most adequate doses as LD_{50} and MLD may be used. (3) The effect of antibacterial substances may be studied during any of the succeeding phases of the experimental infection. Penicillin, for instance, checked the infection at any time from the moment of the inoculation to 6 hours later; other substances might be efficient at only one moment of the infection; others could possibly be effective during even a longer period than in the case of penicillin. (4) The bacteriostatic effect of sulfonamides can also be studied. The infection obtained with some staphylococcus strains was checked by two different sulfonamides used in this work.

The Descendants and Contemporaries of Louis L'Iroquois. Consanguinity and Two Rare Matings: -D-/D-xCDe/-D- and CDe/-D-xcDe/-D-.

D. I. BUCHANAN (*Edmonton*) and J. McINTYRE (*Toronto*), *Canadian Red Cross Blood Transfusion Service. Presented by G. W. Miller, National Director.*

THIS REPORT deals with an interesting chapter in the early pioneer days of Canada and has its origin in a small group of Iroquis Indians which explored the vast inland lake area of Eastern Canada through the Prairies to the Rockies. During their perigrinations it is clear from the records still available that they met up with certain of the French *courriers de bois* and Scottish traders, and over the many years of their journey westwards many marriages and baptisms took place. Geneological research extends downwards from Louis the Iroquis in 1740 to the present day and involved tracing 1,500 names and carrying out serology on as many of the present-day descendants as are living and can be found in the hinterland of the great Canadian North West.

The propositus is Mrs. C., 31 years old, who gives a history of 6 living children and 6 abortions since 1940. She had also received 8 transfusions within the last three years but gives no history of ever having had a previous transfusion reaction.

Subsequent investigation at the Red Cross Reference Laboratory in Toronto in conjunction with the Lister Institute in London proved the propositus to be of the following group and type: O, M N, SS, kk, -D-/-D-, Fy^a+, Lu^a-, $Jk-^a$.

The sister whose blood cross-matched successfully was used as a donor and proved to be of the same genotype, i.e., D--/D--. The other immediate family members fell into the following genotype combinations: father Dce/D--; mother Dce/D--; sisters and brother D--/D and/or DCe/D--. The D--/D--X DCe/D-- mating is unique in itself but on investigation the husband of the propositus was found to be of genotype Dce/D--.

The consanguinity history presents a complicated picture of intermarriage and is the third to have been authenticated in the annals of haematological research.

Intranasal Tetanus Toxoid as a Recall Dose.

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THE TETANUS toxoid used in this study was a highly purified and concentrated product containing 1,200 Lf per ml. A dose of two drops in each nostril was administered to each of 40 persons previously immunized by the subcutaneous route. In the great majority a marked elevation of the antitoxin level had occurred by the fourteenth day.

This response was obtained in spite of a lengthy interval since the last previous dose of tetanus toxoid. In some individuals the interval was 8 to 10 years and in one, 13 years.

The series included two individuals known to be highly sensitive to tetanus toxoid subcutaneously and some others moderately or slightly sensitive. Reactions were nevertheless nil in the majority, minor in a few, and severe in none.

Fatal Type E Botulism in British Columbia due to Salmon Eggs.

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EARLY IN November, 1954, a 19-year-old Indian woman died at Bella Bella, B.C., within 6 to 7 hours after onset of vomiting, followed by "throat trouble", air hunger, and circulatory collapse. Bacterial food poisoning was suspected by the attendant physician, with salmon egg "cheese" as probable vehicle. The deceased and her two sisters had eaten some of these eggs about 12 hours before they all became ill. The two who ate lesser amounts recovered, after developing generalized weakness, associated with vomiting, dryness of mouth, and (in one case) dizziness, blurring of vision and ptosis.

A sample of the crude caviar, prepared 3 to 4 weeks before by traditional tribal methods which would seem remarkably conducive to botulinic and other food poisoning hazards, showed the presence of roughly 2,000 mouse M.L.D.'s of type E botulinus toxin per gram of eggs. A toxigenic culture of *Cl. botulinum* type E was isolated from the eggs, and also from the stomach contents of the deceased.

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Sanitary Inspector required for health unit. Liberal transportation arrangements and good personnel policies. For further details apply to R. S. Peat, M.D., Medical Officer of Health, Stormont, Dundas and Glengarry Health Unit, 104 Second Street West, Cornwall, Ontario. 1–3

Public Health Nurse: Athabasca Health Unit No. 18, Alberta, requires a public health nurse to work in a generalized public health program. Starting salary $2,760–$3,000 according to qualifications. Annual increment $180. Blue Cross and pension plan available. Public health qualifications desirable but not essential. Address communications to Dr. H. M. Brand, Medical Officer of Health, Athabasca Health Unit No. 18, Athabasca, Alberta. 1–1

The Stony Plain-Lac Ste. Anne Health Unit No. 17, near Edmonton, Alberta, requires a Registered Nurse with public health qualifications to start immediately. Minimum salary $2,640.00 and increments $140×3 and $260.×1. Starting salary by arrangement. Applications stating qualifications to the Director of the Health Unit, Stony Plain, Alberta.

Sanitary Inspector, qualified, required by the Department of Health, City of Kingston. Salary range in effect, transportation provided, five day week. Pension and hospitalization plans are available. Apply to Medical Officer of Health, City Hall, Kingston, Ontario.

Medical Officer of Health required by The City of Belleville. Salary $5,000 to $7,000. Annual increase of $250. One month vacation after one year. Car Allowance $40 per month. Blue Cross, P.S.I. and pension plan available. Duties to commence February 1st 1955. Apply to Secretary, Board of Health, City Hall, Belleville, Ontario.